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Event and Comment.

Tropical Agricultural Research.

TROPICAL agricultural development in Queensland has become a matter of major importance. Writing on this subject recently, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said:—

When the solvency of any particular territory depends on a single form of production that locality is a hostage to fortune. This fact has been forcibly if painfully demonstrated during the past few years in our exclusively pastoral areas of the West.

In the North sugar is queen. No other primary industry of a major nature exists, and neither individuals nor institutions can feel secure or confident under this state of affairs. Sugar, of course, could never be dethroned under normal conditions, but we have reached our limits of production in this direction, and must cast about for new avenues of activity.

Necessarily these do not lie in an expansion of secondary industries, but in a closer realisation of our agricultural possibilities. An almost identical position confronted the peoples of the British West Indies, and a tropical research and experiment station was established in an endeavour to provide an answer to the often repeated question, "What agricultural possibilities do the islands offer?" The result has been a surprisingly successful agricultural development, and the institute has obtained world-wide recognition. What Trinidad has done for the Indies the proposed Tropical Research Station at South Johnstone

may accomplish for tropical Queensland, and not only for the northern portion of our State, but for a quarter of the continent, and for the mandated islands under our control.

The proposed location is ideal, for both soil and climate are characteristic of the North. Results, however, will not be obtained in a day or a year. Agricultural research is tedious but inspiring for that small band of men, and latterly of women, who have embarked upon it. The scope of the Bureau will embrace agricultural research, tropical agricultural education and supplementary dietary investigation.

The first of these—agricultural research, and at this institution the most important—will be divided into two groups: the "short-term phase" and the "long-term phase." The first of these will be directed towards the greater application of scientific principles of agriculture, in relation to existing Australian tropical agricultural industries, other than the sugar industry.

Included in this programme will be soil surveys, varietal, fertilizer and cultural trials, improvement of varieties by breeding and selection, and plant protective investigation in entomology or pathology. The crops receiving attention under this section will be maize, tobacco, pastures, and fruit. In the case of fruit, particular attention will be given to the development of supplies of known producing strains, together with suitable standardised stocks, in order to produce a uniform result.

The "long-term phase"—the eminent justification for the establishment of the station—will take the form of fundamental investigation of the possibilities, both agricultural and economic, of at present non-existent tropical agricultural industries. This work will include the introduction, acclimatisation, and selection of strains of plants most suited to tropical Australian conditions, the determination of the most suitable regions in tropical Queensland for the growth of such plants, the development of the most suitable agricultural practices, methods of harvesting and marketing of crops.

The successful development of such industries will naturally be dependent upon economic rather than climatic factors. Particular attention, therefore, will be paid to the development of cultural and harvesting methods, which are less dependent upon unskilled labour than is the case in the other tropical countries of the world. Tropical products which are imported into Australia and which suggest themselves as being desirable of investigation are tea, coffee, cocoa, hemp, spices, kapok, tapioca, edible nuts, vanilla, rubber, and fruits which at present are not grown commercially, such as the mangosteen and the avocado pear.

It is not suggested that the crops enumerated above will all succeed. Were success certain the necessity for a bureau would disappear, but such work constitutes a prerequisite to the successful and permanent agricultural colonisation of the most vulnerable part of our continent.

It must be remembered that educationally no facilities exist anywhere in Australia to provide a training in tropical agriculture for our college and university graduates. South Johnstone will fill this need.

On the establishment of the bureau arrangements will be made to offer facilities to approved graduates to undertake a post-graduate course in tropical agriculture. By this arrangement the research facilities of the University will be definitely linked with a new and important arm of agricultural development.

Agriculture in the tropics is different in many respects from agriculture in the temperate zones, and, in addition to the South Johnstone station, there is, therefore, in contemplation the conversion of Kairi State Farm on the Atherton Tableland into an institution for the imparting of agricultural knowledge associated with certain investigation work. What we contemplate is not another agricultural college but a farm school which will conform to the general requirements of practical agriculture.

We must avoid at all costs the raising of a generation of agricultural labourers. A sound understanding of the principles of agriculture or the absence of this understanding makes all the difference between the agriculturist and the agricultural labourer. Kairi will provide the possibility for this distinction. The Atherton Tableland, with its congenial climate, wonderful soils, and natural agricultural utility, is an ideal setting for the school. In addition, problems of first magnitude can be investigated at first hand on the Tableland in conjunction with the bureau at South Johnstone. Of these the most important is the production of high protein grasses and crops, assets in which the Tableland is conspicuously deficient at the present time.

The two organisations, taken in conjunction, will provide for the well-balanced application of all that is best in agriculture, and should make a valuable contribution to the future development of what is probably the most fertile area in Australia—an area which is merely waiting for a complete understanding of its many difficulties and variations to yield wealth and happiness to the people of the North and to Queensland generally.

Financing the Wheat Pool.

IN reply to a question as to how the wheatgrowers would fare concerning a first advance, which it had been claimed was held up owing to his (the Minister's) decision to extend to 22nd January the date for receipt of a petition for a ballot on the question of the extension or otherwise of the Wheat Pool, the Minister for Agriculture and Stock (Mr. F. W. Bulcock) stated that he understood that the Wheat Board, prior to the extension of the date for the receipt of the petition, had made arrangements with the Commonwealth Bank for suitable financial accommodation.

"I am not aware," said the Minister, "of the nature of that accommodation, but in view of the statement made on behalf of the Board that satisfactory financial arrangements had been made prior to the 8th instant, I confidently anticipate that the Board will now be in a position to expedite the payment of the first advance."

Ticks Infesting Domesticated Animals in Queensland.

By F. H. S. ROBERTS, M.Sc., Entomologist, Animal Health Station, Yeerongpilly.

THE intention in this article has been not only to give an account of the several species of ticks infesting domestic animals in Queensland, but also to place in the hands of the interested stockowner information which it is hoped will enable him to recognise the more important species.

Life History of Ticks.

In the life history of Ixodid ticks four distinct stages are recognised —namely, the egg, the larva, the nymph, and the adult. When engorged the female tick drops from the host animal to the ground, crawls to some sheltered spot, and lays her eggs. After a period, dependent mainly upon temperature and humidity, these eggs hatch to give rise to the tiny larvæ (Plate 26, figs. 6 and 7). The larvæ or seed ticks, as they are frequently called, have only three pairs of legs in contrast to the adult tick's four pairs. After a time sufficient for the body parts to harden the larva crawls up to the top of the grass or some other convenient point, and is eventually brushed off by its host, to which it adheres. A suitable spot on the host animal is found, and the tiny larva inserts its mouth parts and begins to suck blood. When fully fed it may drop off the host to the ground or remain attached to its host, in either case finally casting its skin to appear as a nymph. The nymph has four pairs of legs like the adult, but is not sexually mature and has no genital orifice. If the moult has occurred on the ground, the nymph repeats the activities of the larva, and soon becomes attached to another host. After attachment the nymph in its turn engorges and may detach itself and drop off or remain on the host to undergo the second moult. And now the sexually mature adult appears. The host is eventually reached in the manner of the larva and nymph, and the adult tick begins to feed. The sexes mate and the female engorges rapidly, eventually becoming enormously swollen with blood. She then drops off, lays her eggs, shrivels up and dies.

DESCRIPTION OF PLATE 26.

Fig. 1. *Longirostrata.*—A tick with long mouth parts. (*a*) Mandibles; (*b*) Mandibular sheath; (*c*) Palp; (*d*) Eye; (*e*) Scutum or dorsal shield.

Fig. 2. Ventral view of the Capitulum of a tick showing the mouth parts. (*a*) Mandibles; (*b*) Hypostome; (*c*) Palp.

Fig. 3. *Brevirorstrata.*—A tick with short mouth parts. In this tick—a male—the scutum covers the whole of the back.

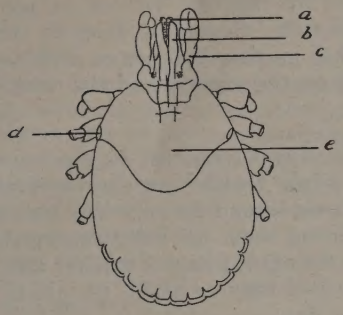
Fig. 4. *Brevirostrata.*—A female tick with the scutum extending over only a small area near the head.

Fig. 5. *Prostriata.*—The anal grove contours, the anus in front. (*a*) Anus; (*b*) Anal groove.

Fig. 5A. *Metastriata.*—The anal grove contours, the anus behind. (*a*) Anus; (*b*) Anal groove.

Fig. 6.—Larva of the cattle tick, *Boophilus microplus* Canes.

Fig. 7. Larva of the scrub tick, *Ixodes holocyclus* Neum.



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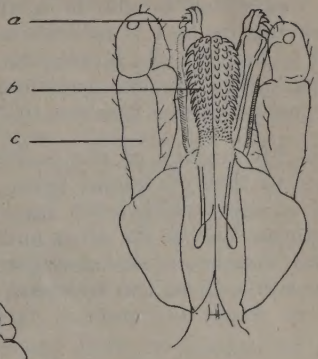

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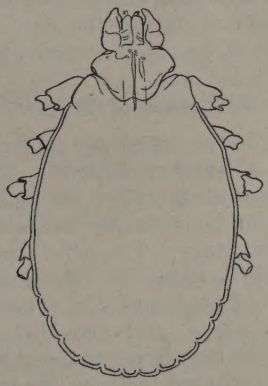

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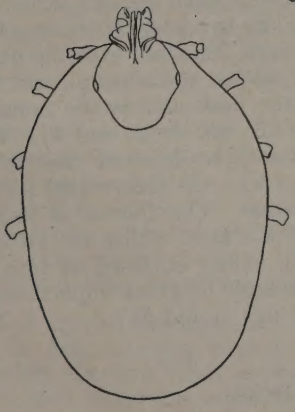

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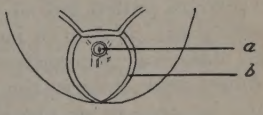

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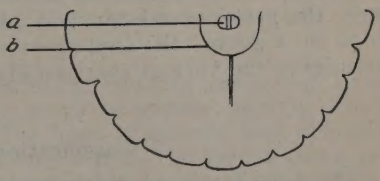

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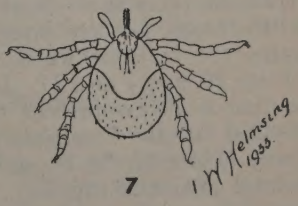

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PLATE 26.

A tick which is able to complete its life history without at any time leaving its host is called a one-host tick. Should it drop to the ground to undergo the larval and nymphal moults, it becomes a three-host tick, whilst only one moult occurring on the ground and the others on the host makes it a two-host tick.

The life history of the poultry tick, *Argas persicus,* is, however, different to that of Ixodid ticks. The adult female may lay several batches of eggs, which hatch into typical six-legged larvæ. The larvæ attach themselves to the birds and remain on them till fully engorged. There are then two nymphal stages before the adult phase is reached and, like the adult, these two nymphal forms feed only at night, remaining hidden in cracks and crevices during the day.

Structure of Ticks.

Generally speaking, ticks have an undivided oval-shaped body protected externally by a leathery cuticle. At the anterior end is a structure known as the capitulum (Plate 26, figs. 1 and 2) which carries the mouth parts, whilst the body proper bears the legs, of which there are four pairs in the adult stage. The mouth parts consist of the beak and the palpi. The beak includes the hypostome, mandibular sheath, and mandibles (Plate 26, figs. 1 and 2). The hypostome can be seen ventrally, is club-like in shape, and provided with rows of recurved teeth (Plate 26, fig. 2). The mandibles are used when the tick is piercing the skin, and the rows of recurved teeth on the hypostome explain why a tick when pulled out so often leaves its "head" behind. On the dorsal surface can be seen in most species a hard shield—the scutum—which in the male covers practically the whole of the back and in the female a smaller area close to the capitulum (Plate 26, figs. 1e, 3, and 4). Eyes may be present or absent, and if present may be detected close to the lateral angle of the scutum (Plate 26, fig. 1d.). On the ventral surface will be found the genital and anal openings. The former is usually situated far forward between the coxæ of the legs, whilst the latter is nearer the posterior margin and generally partly enclosed in front or behind by a grove—the anal grove—a character of great importance in determining the various species (Plate 26, figs. 5 and 5a).

Classification of Ticks.

The super-family to which the ticks belong is known as the *Ixodoidea,* which is divided into the families *Argasidæ* and *Ixodidæ.* In the *Argasidæ* there is no dorsal shield or scutum, the back being provided with a tough, leathery integument only. Moreover, the mouth parts and palps are invisible when viewed from above, being placed ventrally (Plate 26, figs. 7 and 8). In the *Ixodidæ* these parts are terminal and a scutum is always present (Plate 27, figs. 1-6). The *Ixodidæ* are then divided into the *Prostriata,* in which the anal grove contours the anus in front (Plate 26, fig. 5) and the *Metastriata* where it contours the anus behind (Plate 26, fig. 5a). Finally, the *Metstriata* comprise the short mouth part ticks, the *Brevirostrata* (Plate 26, figs. 3 and 4), and the long mouth part ticks, the *Longirostrata* (Plate 26, fig. 1).

The Poultry Tick (*Argas persicus* Oken 1818).

(Plate 27, figs. 7 and 8.)

This is a cosmopolitan species, and is to be found in every part of this State. It not only attacks fowls, but also ducks and pigeons. It appears to thrive in the drier parts of Queensland, and is regarded as a serious pest of poultry wherever it occurs. This species, except in the larval stage, feeds only at night, and when present in numbers may cause serious mortalities, especially among young birds. Its survival in fowl-houses which have remained empty for considerable periods of time is astounding. One such record made in one of the hottest and driest parts of the State is that of a fowl-house which remained infested for two and a-half years, during the whole of which time it was not inhabited by fowls.

The prevalence of *spirochætosis* among fowls in Queensland is not known to any degree of accuracy, but frequently cases have been encountered where mortalities have definitely been caused by this disease.

The poultry tick is a flat, oval, leathery tick, without a dorsal shield or eyes. The mouth parts are entirely invisible when viewed from the dorsal surface, which is marked with numerous symmetrically arranged discs more or less disposed in radial lines.

The Scrub Tick (*Ixodes holocyclus* Neumann 1899).

(Plate 27, figs. 3 and 4.)

This tick also known as the "bottle" tick appears to be confined to the coastal scrubs, with a distribution as far west as Toowoomba, and extending northwards to the Atherton Tableland and Norman River. Its native hosts comprise the wallaby, kangaroo, opossum, bandicoot, native bear, pouched mouse, &c., among which it does not appear to cause any great inconvenience. On man and the domesticated animals, however, the presence of this tick may be responsible for a serious condition, which may be followed by paralysis and death. Such fatalities are especially noticeable among dogs and sheep, but deaths from scrub tick attack is also known among cats, foals, calves, pigs, fowls, ducks, and even man. In several North Coast areas the successful raising of sheep is prevented mainly through the mortalities from this tick, especially during the spring months.

This species is a three-host tick—that is, the larva and nymph drop from the host in order to undergo the moulting process, gaining a new host when the new stage appears. The male is an oval tick, rounded behind, and somewhat reddish-yellow in colour. The mouth parts are terminal, long and prominent. The partly-fed female is greyish, but when fully engorged this sex becomes very large and dark red. If the anal grove is examined, it will be found that in both sexes it contours, the anus in front converging behind, so that it meets at the edge of the body in the female, but remains narrowly open in the male.

The Opossum Tick (*Ixodes tasmani* Neumann 1899).

There is a single record of this tick occurring on a horse. Other hosts from which the opossum tick have been collected include the opossum, native bear, native cat, and man. This species has been recorded from Gayndah, Eidsvold, Bundaberg, Brisbane, Logan, Boyne Valley, Jondaryan, Harrisville, and Roma.

The opossum tick is very similar to the scrub tick, but may be distinguished by the anal grove, which is this species is not convergent behind but remains almost parallel.

The Brown Dog Tick (*Rhipicephalus sanguineus* Latreille 1804).

(Plate 28, figs. 3 and 4.)

Like the poultry tick, the brown dog tick is a cosmopolitan species, and may be found anywhere in Queensland. Some of the heaviest infestations have been observed in the driest and most remote portions of the State. Infestation of dwellings by this tick are not uncommon, due to carelessness in allowing infested dogs indoors. The fact that this is a three-host tick and that the dog is a thoroughly domesticated animal probably explains its wide distribution. In other parts of the world the brown dog tick is a vector of canine pyroplasmosis, but so far as can be ascertained this disease is not present among dogs in Australia.

The brown dog tick bears a superficial resemblance to the cattle tick, but may be readily recognised by its brown legs, the presence of an anal grove, and by the conspicuous bifid first coxæ. Other hosts on which this tick may be found are sheep, cattle, horse, cat, and man.

The Cattle Tick (*Boophilus microplus* Canestrini).

(Plate 27, figs. 1 and 2.)

This species, previously known as *B. australis*, is without doubt the most important of all ticks found in Queensland. It is not a native species, and occurs also in Asia, South America, and South Africa. Its importance lies in the fact that not only has it found climatic conditions so suitable for its development that it has become a serious cattle pest in itself, but it is also the vector of *Piroplasma bigeminum*, which is responsible for cattle-tick fever and probably of two or three other organisms which are possibly concerned with other serious cattle diseases.

This cattle tick is a one-host tick. It may be readily distinguished from other ticks found on cattle in Queensland by the following features:—

(1) The mouth parts are small and the palps do not project laterally at their base as in some species of *Hæmaphysalis*.

(2) Eyes are present. In the species of *Hæmaphysalis*, with which *B. microplus* is most likely to be confused, eyes are absent.

DESCRIPTION OF PLATE 27.

CATTLE TICK—*Boophilus microplus* Canes.

Fig. 1.—Male × 5. Fig. 2.—Female × 5.

SCRUB TICK—*Ixodes holocyclus* Neum.

Fig. 3.—Male × 5. Fig. 4.—Female × 5.

WALLABY TICK—*Hæmaphysalis bancrofti* (Warburton and Nuttall).

Fig. 5.—Male × 5. Fig. 6.—Female × 5.

FOWL TICK—*Argas persicus* Oken.

Fig. 7.—Male × 7. Fig. 8.—Female × 7.

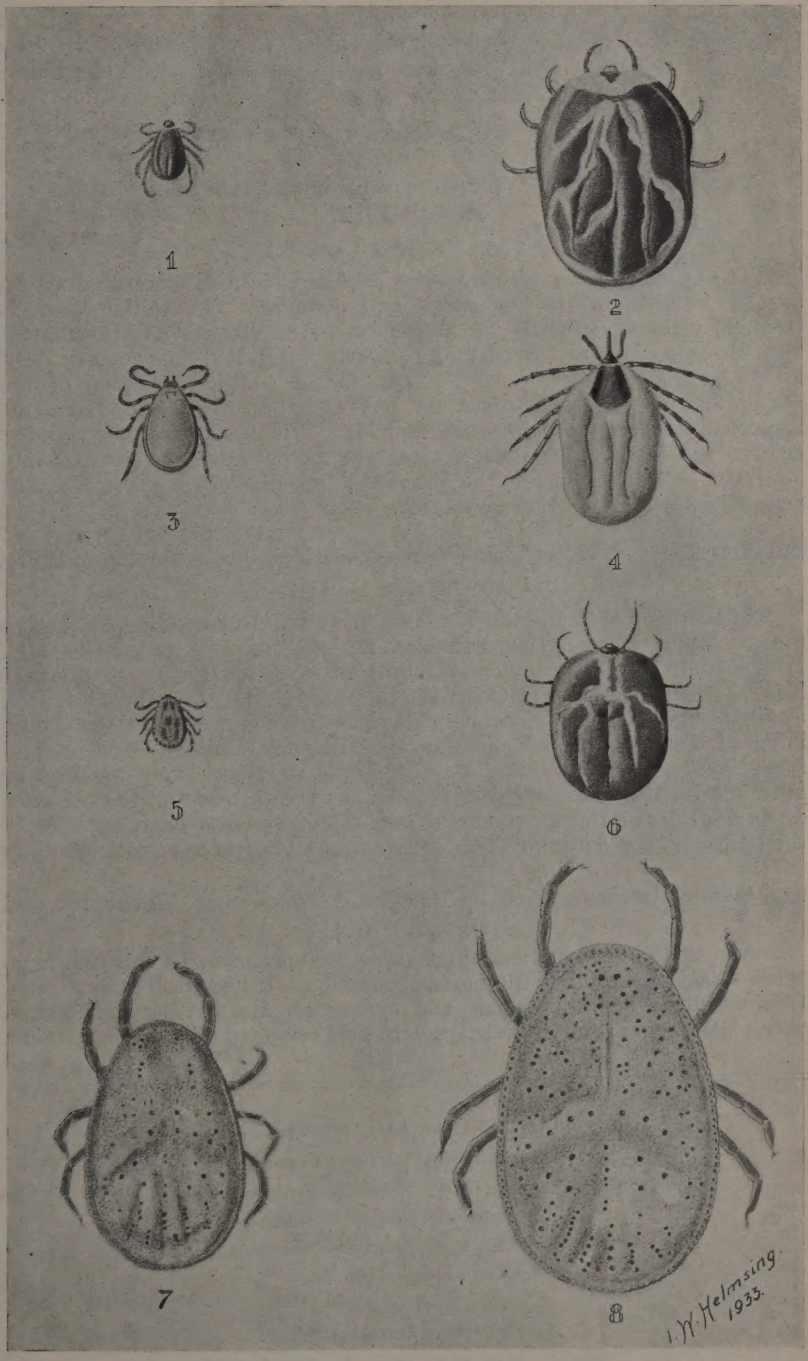

Plate 27.

(3) There is no apparent anal grove.

(4) The legs are short and very pale. *B. microplus* is the only species of tick with short mouth parts and with pale almost whitish legs.

This species has also been recorded from horses, sheep, and dogs.

The Wallaby Tick (*Hæmaphysalis hancrofti* **Warburton and Nuttall 1915).**

(Plate 27, figs. 5 and 6.)

The species of the genus *Hæmaphysalis* have a distinct anal grove, usually laterally projecting palps and no eyes. The wallaby tick is frequently found on cattle and is recorded from Townsville, Rockhampton, Murgon, Maleny, Brisbane, Kingaroy, Helidon, Toowoomba, and Maryvale. It appears to be confined to the southern portion of the State, mainly the south-east. It has also been collected from the kangaroo, rat-kangaroo, opossum, and man. In this species the legs are brown, the mouth parts short, and the palps project very strongly laterally. The life history is unknown, but like other species of the genus it is probably a three-host tick.

The New Zealand Cattle Tick (*Hæmaphysalis bispinosa* **Neumann 1897).**

(Plate 28, figs. 1 and 2.)

This introduced species is found in India, Burma, Borneo, Malay States, Japan, East Africa, and New Zealand, as well as in Australia. It is said to be very commonly found on cattle on the north coast of New South Wales, but in Queensland, so far as the records show, it is by no means common. Specimens have been taken from cattle at Tullebudgera, Toowoomba, Bell, Jondaryan, Killarney, Helidon, Murgon, and from horses at Taroom and Gympie. This species may readily be mistaken for the common cattle tick, but its brown legs and the presence of an anal grove and a prominent dorsal spine on the third segment of the palps readily distinguish it. This species is a three-host tick.

The Slender Opossum Tick (*Hæmaphysalis humerosa* **Warburton and Nuttall 1929).**

Among the material examined there are specimens of this tick from cattle at Rockhampton and a horse at Helidon. It has also been collected from bandicoots and opossums at Maryborough, Harrisville, and Springsure. The dorsal shield or scutum in this species is much longer than

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DESCRIPTION OF PLATE 28.

Hæmaphysalis bispinosa Neum.

Fig. 1.—Male × 5. Fig. 2.—Female × 5.

Rhipicephalus sanguincus Latr.

Fig. 3.—Male × 5. Fig. 4.—Female × 5.

Hyalomma ægyptium Linné.

Fig. 5.—Female × 5.

Amblyomma triguttatum Koch.

Fig. 6.—Male × 5. Fig. 7.—Female × 5.

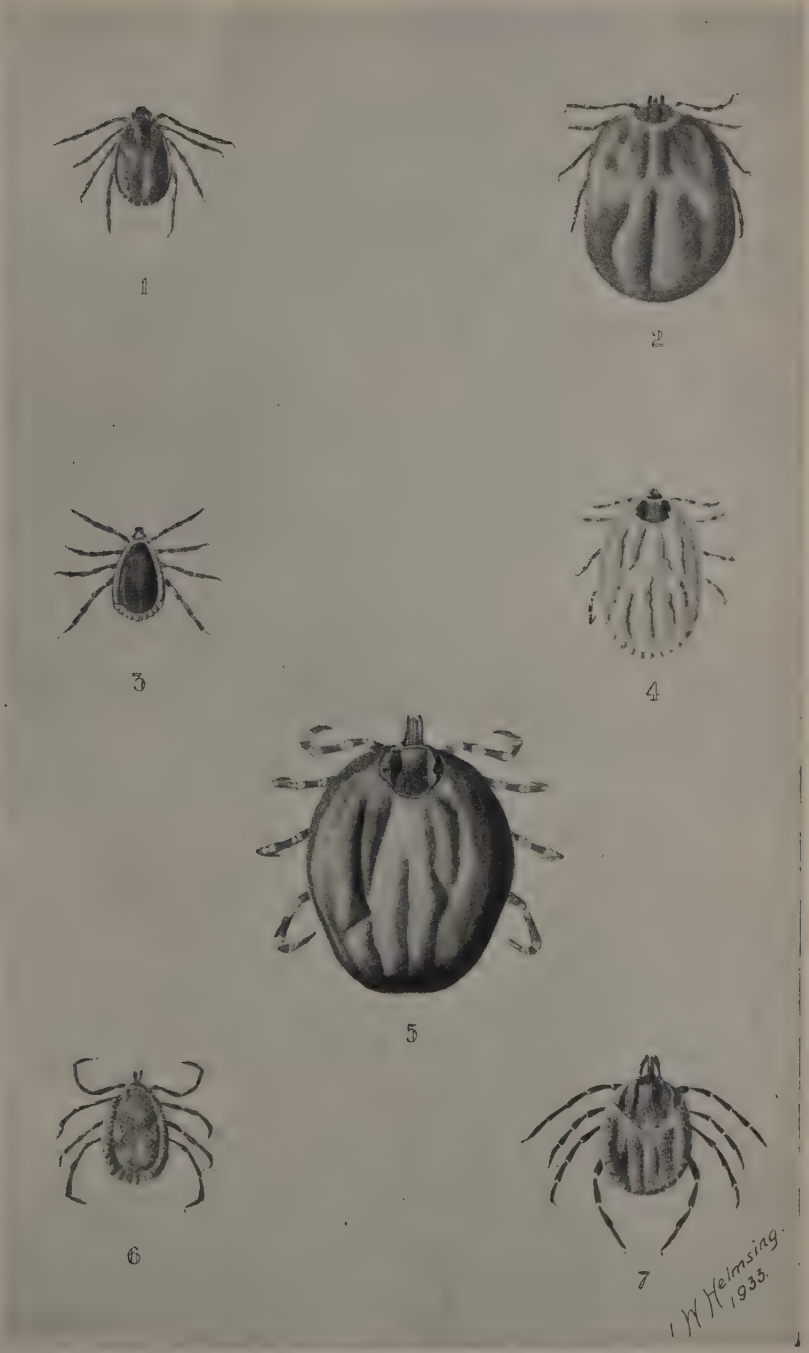

Plate 28.

broad, giving the male a long, slender appearance, a peculiarity which is not quite so marked in the female.

The African Dog Tick (*Hæmaphysalis leachi* (Audouin 1827) (Neumann 1897)).

This species has been recorded from Australia from the wallaby and from a horse. The writer has never encountered this tick, but is informed by Dr. J. Legg, of the Animal Health Station, Townsville, that he has taken it there on sheep. This tick also occurs in Africa, India, Sumatra, Borneo, Malay States, and New Zealand. In Africa it transmits the organism of malignant jaundice or pyroplasmosis of dogs.

The Bont Leg Tick (*Hyalomma ægyptium* Linne 1758).

(Plate 28, fig. 5.)

The material examined included two females of this species from a bullock and horse respectively at Warwick. The bite of this tick is particularly severe, and has a notorious tendency to cause abscesses and sloughing of the skin. It is readily recognised by its branded legs and dull brown body. This and the remaining species dealt with hereafter belong to the *Longirostrata*—that is, the mouth parts are conspicuous and long. The bont leg tick is very common in India and Africa, and has also been recorded from parts of Europe. This is a two-host tick.

The Kangaroo Tick (*Amblyomma triguttatum* Koch 1844).

(Plate 28, figs. 6 and 7.)

As this species is normally found on kangaroos, its distribution in Queensland is fairly extensive. Localities from which it has been recorded extend from Burketown and the Norman River in the north to the Logan River in the south, and as far west as Camooweal, Longreach, and Augathella. Domesticated animals from which it has been collected include cattle, horse, and dog, while the native hosts comprise the wallaby, platypus, and dingo, besides the kangaroo.

This tick may be readily recognised by the conspicuous coloration of the dorsal shield. In the female this shield is reddish-brown with a single whitish spot in the posterior angle. In the male there are a pair of irregular pale areas in the lateral fields and a pair of smaller spots posteriorly. Variations in this colour scheme are frequent, the most usual being to find on the female scutum an irregular pale area laterally in addition to the posterior spot. The male scutum may show a broad median band with extensive lateral markings. The life history of the kangaroo tick is unknown.

The Snake Tick (*Amblyomma moreliæ* L. Koch 1867).

The native hosts of this species include several species of snakes and goannas, the wallaby, and kangaroo. The domesticated animals from which this tick has been collected comprise cattle at Hughenden and a horse at Rosewood. Other locality records are Ingham, Bowenville, Toowoomba, and Esk. The male tick has two pairs of irregular pale areas in the scapular fields of the dorsal shield and two or three pairs of small spots behind the eyes and extending along the conspicuous marginal grove posteriorly. The female has a reddish-brown dorsal shield with a marked but irregular pale area near each eye.

The Bont Tick (*Amblyomma hebræum* Koch).

There is a female of this species in the departmental collection. The locality is not legible on the label and the host is given as a horse. The presence of this tick in Queensland is therefore not at all certain.

The Goanna Tick (*Aponomma trimaculatum* Lucas 1878).

In this genus the eyes are absent, and, as in *Amblyomma*, the mouth parts are conspicuous and long. The males are usually small, broad, and almost circular in outline, the females being larger and somewhat similar in appearance. This species is a small brilliantly coloured tick occurring in North Queensland and New Guinea. The usual hosts are snakes and goannas, but among the material is a specimen from a horse at Townsville.

Instructions for Collecting Ticks.

The species of ticks occurring in Queensland are by no means adequately known, and great assistance could be given by interested persons by forwarding any specimens they may come across. Ticks may occur on any of the domestimated animals, the many species of marsupials, snakes, goannas, lizards, tortoises, and birds. In the case of birds, ticks are frequently found in the nests. The specimen should be detached by a slow, gentle pull, so that the mouth parts are not injured, and forwarded in a match box, packed round with paper to prevent the specimens moving about, or in spirit, to the Animal Health Station, Yeerongpilly, Brisbane.

ACKNOWLEDGMENT.

The writer desires to acknowledge his appreciation of the illustrations by Mr. I. W. Helmsing, Illustrator, Entomological Branch, through the courtesy of the Chief Entomologist, Mr. Robert Veitch.

TO NEW SUBSCRIBERS.

New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

Banana Thrips Control.

By ROBERT VEITCH, B.Sc. Agr., B.Sc. For., F.E.S., Chief Entomologist.

THE very small and insignificant insect known as the banana thrips (*Scirtothrips signipennis* Bagnall) occupies second place in the list of Queensland insect enemies of the banana, for it has to yield pride of place to the banana weevil borer (*Cosmopolites sordida* Chevr.) which is present in practically every large banana-growing district in Queensland.

The sum total of losses due to the borer is undoubtedly greater than that resulting from the activities of the thrips, but two significant differences in the incidence of infestation merit attention. Firstly, losses in the quantity and quality of fruit as a result of borer attack are greater than is generally realised, mainly because borer infestation is not very obvious; on the other hand, the rust produced in a severe thrips attack cannot possibly escape notice. Secondly, where thrips does occur in epidemic proportions with severe associated rust, virtually the whole cut of fruit on a plantation may be lost. Hence, although a State-wide estimate of losses shows weevil borer to be responsible for the greater damage, it actually happens that in certain restricted areas thrips is a much more destructive insect in so far as the reduction of marketed fruit is concerned.

Distribution in the State.

The banana thrips is well distributed throughout Queensland and occurs in small numbers in quite a number of districts in which banana-growers have sustained no losses of fruit, and, indeed, in some cases the growers are not even aware of the presence of the insect, which can, of course, be readily overlooked unless carefully searched for. There are, however, two districts in which it has been abnormally abundant and in which it has been responsible for devastating losses; these are Gympie and the far north of Queensland. A very serious outbreak occurred in the Gympie district in 1924, but for a number of years thereafter losses were comparatively slight. However, in 1931 the position once more became acute and further serious losses occurred. The history of the Gympie outbreaks thus indicates a very pronounced seasonal fluctuation in losses, and shows that although losses may be serious one year it does not necessarily follow that they will continue so without interruption. The second district in which losses have been very heavy is the coastal banana-producing area north of Cardwell, in North Queensland.

Nature of Injury.

Both the larval and adult thrips feed on the skin of the fruit, and the term "rust" has been appropriately used to denote the type of injury characteristic of outbreaks of this pest. Rust in bananas, however, is in no way analogous to rust in wheat, for the latter is due to the presence of a fungus, whereas the former is the reaction of the skin of the fruit to the feeding of an insect. The attacked skin presents a typical reddish-brown appearance and has a somewhat rough surface. The discoloration and roughening of the skin may be confined to the point of contact of the individual fruits at the stalk end of the fruit. It can, however, extend over practically the whole of the surface of the fruit, which may subsequently become badly cracked.

A small amount of rust on a banana does not affect the palatability of the fruit, although it certainly renders its appearance less attractive. In cases where the skin is badly rusted, however, the quality of the fruit is definitely impaired, and large quantities of fruit may be rendered quite unmarketable.

Plate 29.—Banana Fruit showing "Rust" due to Thrips Attack.

Life History and Life Cycle Stages.

The very small eggs of the thrips are laid in the plant tissue, the eggs being deposited therein in punctures made by the adult insect. They are commonly laid on the fruit, particularly at the points of contact between the individual fruits and also under the leaf sheaths. Colonies are most numerous in these two parts of the plant.

The eggs hatch out in about a fortnight, and the white-coloured larvæ emerging therefrom become full grown in a week, being then approximately one twenty-fifth of an inch in length. The full-grown larvæ generally pupate in the soil, but pupation may occur on the plant, and after a pupal period of about a week the delicate yellow-coloured adults emerge. They possess two pairs of narrow-fringed wings, at the base of each of which there is a distinct dark area.

There is not infrequently some uncertainty as to the identity of small insects associated with bananas, and species of insects known as

springtails, most of which are merely scavengers, have been mistaken by growers for the dreaded banana thrips. Should a grower be in any doubt on that point, he should forward specimens to Mr. N. E. H. Caldwell, Assistant to Entomologist, Department of Agriculture and Stock, Nambour, who will be only too pleased to definitely identify the specimens.

Thrips Control Experiments.

Having indicated the nature of the damage and of the insect responsible for it, an outline of what may be done to control this pest can now be given, and from the grower's point of view that is, of course, a vitally important matter.

A very considerable amount of attention has been devoted to the problem of control, and extensive field experiments have been carried out by departmental officers. Indeed, the results of certain large scale experiments in North Queensland have just been published in the "Queensland Agricultural Journal," and it is largely on the results of these experiments that the present control recommendations are based. These recommendations will be found to be very useful, but an effort is being made to still further improve on them. With this object in view the Minister for Agriculture and Stock appointed an officer in June of last year to work full time on the thrips problem, and that officer recently initiated a number of field experiments. The investigator in question, Mr. N. E. H. Caldwell, is a State departmental officer, but his appointment was made possible by a grant from the Commonwealth Banana Committee.

Control Measures.

Where infestation occurs and the thrips is present in large numbers, growers should give serious consideration to dusting the bunches at regular intervals during the warmer months of the year. In the present state of knowledge, the most effective dust to use is a nicotine dust, preferably one in which the nicotine is present as free nicotine, although dusts in which the nicotine is present as nicotine sulphate can also be used with beneficial results.

The dusting should be done at weekly intervals. Ideally the dust could be applied with a rotary duster fitted with a special flexible outlet pipe; dusting can, however, be accomplished by the use of a relatively inexpensive hand dust gun. The latter type is actually in use for the present series of experiments. The exact time of the year at which dusting should commence on any particular plantation must, of course, be left to the discretion of the individual grower. Growers are reminded that caution must be exercised in the application of dusts for, if unnecessarily large quantities are used, an unsightly residual deposit may eventually accumulate on the fruit.

A grower situated in a district in which thrips is known to occur would be well advised to inspect the bunches at regular intervals, and if thrips shows signs of becoming abundant, then, as indicated, dusting the bunches with nicotine dusts is the most promising control measure to adopt.

Obviously, where areas are free from thrips infestation, every effort should be made to keep them so, and it would be manifestly unwise to introduce suckers to such a clean area from one already known to be infested. In this connection it has sometimes been suggested that suckers might be freed from thrips infestation by dipping in nicotine sulphate.

Such dipping cannot, however, be relied upon to completely free the suckers from infestation, although it will undoubtedly reduce the number of thrips associated with the plants.

Each year the Banana Industry Protection Board drafts a planting policy, in which the securing of suckers is discussed. Growers should therefore make themselves acquainted with the current planting policy, particulars of which can be obtained from the local agent of the Board.

Finally, in combating the thrips menace, growers at present will have to rely mainly on dusting the bunches with nicotine dusts in areas where infestation is severe. Where infestation does not occur, every precaution must be taken to maintain these areas free from thrips.

QUEENSLAND SHOW DATES, 1934.

Stanthorpe: 7th and 9th February.
Killarney: 16th and 17th February.
Allora: 7th and 8th March.
Clifton: 14th and 15th March.
Tara: 21st March.
Milmerran: 20th March.
Goombungee: 28th March.
Pittsworth: 4th and 5th April.
Warwick: 10th and 12th April.
Toowoomba: 16th and 19th April.
Rosewood Camp Draft: 7th April.
Goondiwindi: 27th and 28th April.
Oakey: 28th April.
Taroom Camp Draft: 30th April.
Taroom: 1st and 2nd May (Camp Draft, 5th May).
Dalby: 2nd and 3rd May.
Beaudesert: 2nd and 3rd May.
Charleville: 8th and 10th May.
Nanango: 3rd and 4th May.
Blackall: 7th and 9th May.
Chinchilla: 8th and 9th May.
Crow's Nest: 9th and 10th May.
Boonah: 9th and 10th May.
Monto: 9th and 10th May.
Kingaroy: 10th and 11th May.
Ipswich: 15th to 18th May.
Miles: 16th May.
Kilkivan: 16th and 17th May.
Mitchell: 16th and 17th May.
Mundubbera: 16th and 17th May.
Wondai: 17th and 18th May.
Roma: 22nd to 24th May.
Gympie: 23rd and 24th May.
Biggenden: 24th and 25th May.
Murgon: 24th to 26th May.
Toogoolawah: 25th and 26th May.
Kalbar: 26th May.
Goomeri: 29th and 30th May.
Wallumbilla: 30th and 31st May.
Maryborough: 1st, 2nd, and 4th June.
Childers: 5th and 6th June.
Marburg: 1st and 2nd June.
Bundaberg: 7th to 9th June.
Lowood: 8th and 9th June.
Rockhampton: 19th to 23rd June.
Mackay: 26th to 28th June.
Laidley: 27th and 28th June.
Proserpine: 29th and 30th June.
Townsville Camp Draft: 30th June.
Bowen: 4th and 5th July.
Gatton: 4th and 5th July.
Kilcoy: 5th and 6th July.
Townsville: 10th to 12th July.
Woodford: 12th and 13th July.
Rosewood: 13th and 14th July.
Cleveland: 13th and 14th July.
Cairns: 17th to 19th July.
Charters Towers: 18th and 19th July.
Nambour: 18th and 19th July.
Caboolture: 20th July.
Atherton: 24th and 25th July.
Pine Rivers: 27th and 28th July.
Royal National: 6th to 11th August.
Home Hill: 31st August and 1st September.
Imbil: 7th and 8th September.
Ingham: 7th and 8th September.
Beenleigh: 20th and 21st September.
Rocklea: 22nd September.
Malanda: 26th and 27th September.
Kenilworth: 29th September.

Yeasty Rot of Pineapples and Its Control.

By H. K. LEWCOCK, M.Sc., B.Sc. Agr., Pineapple Pathologist.

FOR a number of years, considerable wastage has occurred in Queensland pineapples shipped to the markets of the Southern States through ripe rots which develop during transport and storage. These losses occur chiefly during the summer months, and to a considerable extent are due to the disease variously known as soft rot or water blister. In addition to this disease, however, there is another type of pineapple spoilage—namely, yeasty rot—which under certain conditions may cause considerable damage to fruit which has to be transported long distances. Yeasty rot also occurs under field conditions, and it is in this form only that the disease is known to most growers, who regard it as a minor trouble almost solely restricted to injured or over-ripe fruit. Likewise, fruit merchants and other trade interests have mostly failed to recognise the wastage caused by yeasty rot, as on the Southern markets there appears to be an almost universal tendency to regard all spoilage occurring in pineapples as being due to water blister. That such is not the case, however, is indicated by reports supplied through the courtesy of the Committee of Direction of Fruit Marketing from their Melbourne representative, who has estimated losses from yeasty rot in individual consignments as high as 40 per cent. Through the same organisation arrangements were made for samples of these affected fruit to be returned to Brisbane in aseptic containers for examination; the causal organism of the disease was recovered from two-thirds of the samples so received.

Description of the Disease.

External Symptoms.—A diseased condition of a pineapple affected with yeasty rot is usually not apparent until fermentation of the tissues is well advanced. Normally, the first characteristic signs of the disease are the bubbles of gas and liquid which exude from the injury or crack through which infection occurred. As fermentation progresses the fruit loses weight rapidly, due to the escape of gas and liquid, and the skin becomes leathery in texture and spongy to pressure. Finally, when all the juice has exuded, the fruit is reduced to nothing more than a shell enclosing a mass of fibro-vascular strands. In contrast to soft rot, the skin of fruit affected with yeasty rot does not become thin and brittle, but remains thick and tough. No external discoloration of the skin accompanies the actual fermentation, but in the final stages of the disease secondary rot organisms frequently induce a brown decay.

Internal Symptoms.—The flesh of fruit affected with yeasty rot has a somewhat stringy or fibrous appearance, and is ruptured and torn with large air-filled cavities extending from just below the skin almost to the core. These cavities are caused by exudation of fermenting juice. Affected tissues are canary-yellow in colour, in marked contrast to the light straw-coloured flesh of sound fruit.

The Causal Agent and Mode of Infection.

As its name implies, yeasty rot is a fermentation disease caused by various species of yeasts (*Saccharomyces*). As is the case with many other fruits, species of yeast occur normally on the surfaces of ripening pineapples. Experimental studies have shown, however, that infection

occurs only through injuries or growth cracks which rupture the skin of the fruit. The yeasts themselves are unable otherwise to penetrate this protective covering. Unlike the soft rot disease, yeasty rot infection has not been observed to take place through the cut end of the stalk.

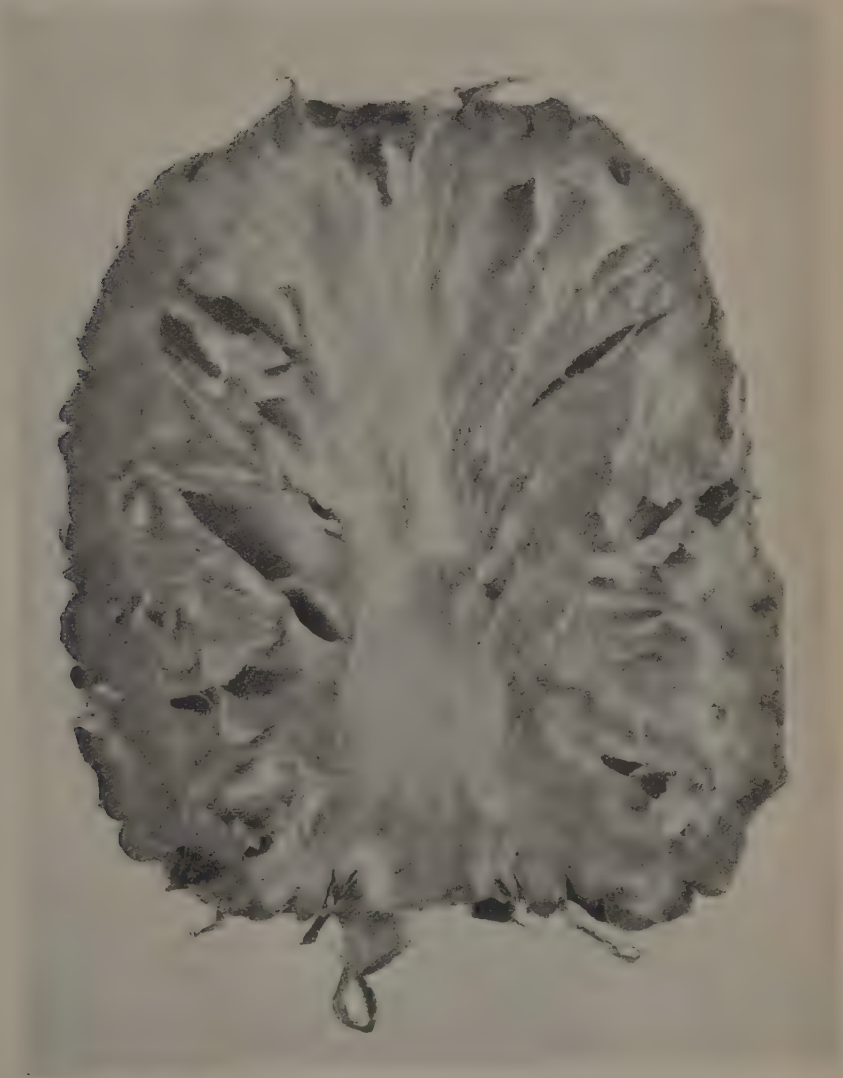

Plate 30.—Yeasty Rot of Pineapple (Internal View).

Factors Influencing Infection.

Maturity of the Fruit.—Ripeness of the flesh, irrespective of the degree of skin coloration, is a prerequisite to infection. This may occur before the fruit is picked or after picking and while the fruit is in transit to the market.

Temperature.—Like water blister, the development of yeasty rot is favoured by high temperature conditions and inhibited by low temperatures. During the warmer months of the year, yeast infection occurring through injuries inflicted in ripe fruits by mice, birds, &c., leads to a rapid fermentation of such fruit under field conditions. In such cases, however, the disease causes no material loss. High temperature conditions obtaining during transportation of fruit to the Southern markets constitute a more serious matter. The carriage of fruit to Melbourne by rail occupies a period of four days, and should this take place during hot, sultry weather, the normally unfavourable temperature conditions of the confined van space are accentuated by retarded ventilation and the heat given off by the fruit during respiration. Under such circumstances, yeasty rot may cause heavy loss before the fruit arrives on the market, unless precautions have been taken during packing to minimise the possibility of infection.

Rainfall.—Although economic losses from yeasty rot occur chiefly in connection with the shipping of pineapples to the Southern markets during the summer months, spoilage occurs in such an irregular manner that its development is obviously determined by some inciting influence other than high temperature. It has been found that incidence of rainfall during the growth of the fruit is the chief factor which indirectly limits the development of yeasty rot in pineapples during transport. A protracted period of dry weather during the summer growing season results in the fruit becoming "skin bound" as they approach maturity. Should heavy rains occur at or about the time the fruit is ripening, sudden swelling of the tissues takes place, resulting in the development of minute cracks and fissures in the tightly bound skin. It is through growth cracks arising in this manner that the yeasty rot organism gains entry to sound, marketable fruit. Weather conditions such as those outlined above obtained fairly generally during the summers of both 1932 and 1933 and, consequently, heavy losses from yeasty rot occurred in many interstate shipments of pineapples made in these years. In seasons of normal rainfall, however, the disease does not appear to be of very great importance.

Control Measures.

The percentage of marketable fruits affected under field conditions is seldom high enough to cause appreciable wastage and, consequently, the need for controlling losses from this form of the disease rarely arises. It is only during the transport of fruit to distant markets that losses from yeasty rot are of economic importance. Such losses may be rendered negligible or entirely avoided if—in addition to the careful handling customarily given to fruit intended for interstate markets—the following precautions are observed at times when the disease is likely to occur:—

(1) When packing for distant markets, discard all fruits showing abrasions or recent growth cracks, the presence of which is usually indicated by exuding juice. Ordinarily, such fruits are quite acceptable for cannery purposes if processed without delay, or they may be disposed of through any other local outlet which will permit them to pass into consumption quickly.

(2) Avoid packing fruit while still wet from rain or dew, and use only packing material which is thoroughly dry.

(3) Practice strict sanitation both in the field and in the packing shed. Damaged or diseased fruit should not be left to decay in the plantation or thrown into a heap near the packing shed, but should either be buried or removed to low-lying waste land where they are not likely to prove a source of infection.

COLD STORAGE OF TOMATOES.

How far is it practicable to hold tomatoes in cold storage, in order that temporary gluts may be relieved and better average returns ensured? The genesis of recent investigations in this connection, states the "Agricultural Gazette" of New South Wales, was the mention by Messrs. Granger Bros., of Narrandera, in a letter to the Department of Agriculture, of the fact that tomatoes if picked green would keep up to two months in their district at an average temperature of 50 deg. Fahr. (natural temperature), the fruit gradually ripening during storage. They suggested that perhaps it would keep for several months at a lower temperature in a cool store. Subsequently they forwarded four cases of Bonny Best tomatoes to the Sydney Municipal Cold Storage Works for trial.

The tomatoes were very green when stored; no special attention was given to the method of packing, the cases being merely lined with paper. The storage temperature was about 34 deg. Fahr. For the first three weeks no alteration was noticed in the colour or appearance of the tomatoes, and when cut open they appeared the same as when placed in store. At the end of four weeks a slight shrivelling of the skin, especially around the stalk, was noticed, and the colour, if anything, was not as green as before. After the sixth week the fruit broke down completely, spots of mildew appeared around the stalk and anywhere on the skin where there were any blemishes, the colour changed to a yellow-green, and the fruit took on a distinct waxy or glassy appearance.

Apparently three to four weeks would be the limit of cool storage for this variety of tomato under the conditions observed above, as from this time the fruit very quickly deteriorated, and it is very doubtful if it could be taken from store and ripened before it broke down completely.

In the report of the Food Investigation Board for 1927 (England), it is stated that tomatoes kept at a temperature of 34 deg. Fahr. for four days or less ripened normally at ordinary temperature and showed a rate of wastage no greater than that of tomatoes which had not been exposed to a low temperature. If, however, the period during which the tomatoes were kept at 34 deg. Fahr. was increased to six or more days the fruit failed to ripen normally after removal from storage and an unusually rapid wastage occurred. It also stated that tomatoes are injuriously affected by storage for more than a short time at temperatures below 50 deg. Fahr.

The injurious effects of storage at 34 deg. Fahr. is not reflected in rate of wastage while the fruit is kept at that temperature, but becomes apparent after removal to higher temperature. Storage at this low temperature would only be of value if consumption occurred before fungal rotting commenced, which may begin within twenty-four hours after removal from storage.

In a more recent publication—viz., "Tropical Agriculture" (B.W.I.), Vol. X., No. 6—Wardlaw and McGuire state that they found that tomatoes picked full grown but green could be successfully held in cold storage at 47.5 deg. Fahr. for periods up to twenty days, and thereafter ripened and held at 70 deg. Fahr. for ten to fourteen days without undue wastage. Fruit that had escaped fungal infection did not undergo deterioration on removal from cold store.

Barn Spot of Tobacco.

PRELIMINARY INVESTIGATIONS AND FLUE-CURING EXPERIMENTS.

By L. F. MANDELSON, B.Sc. Agr., Assistant Plant Pathologist.

FROG eye leaf spot and barn spot of tobacco are both the result of infection by the parasitic fungus *Cercospora nicotianæ*. The former blemish develops in the field, whereas the latter develops during curing, and is most pronounced at about 110° F. when the leaf is drying out. The various field aspects of this disease have been fully discussed elsewhere in this Journal.[4]

Frequently tobacco leaf is considerably damaged during curing through the development of barn spot, even when the amount of frog eye in the field is not very great. Hence it was realised that any modification of the curing process which would retard the development of barn spot would be of considerable economic importance.* Consequently the nature of barn spot and the effect of variations of temperature and relative humidity upon the growth of the causal fungus and on the development of spots have been studied, with the ultimate object of lessening the development of the trouble during curing by a variation of curing practice. The results of this work form the subject of the present article.

Effect of High Temperatures Prior to Curing.

It has been reported that in some countries barn spotting is more or less controlled by subjecting tobacco leaf to fairly high temperatures prior to curing. Hopkins[2] states that some growers in Rhodesia run the temperature in the barns up to 160° F. as quickly as possible, and then rake out the fires and allow the barns to cool to the normal temperature prior to proceeding with curing in the usual way. Similarly, Butler[1] reports that in Nyasaland the extension of spots during curing is checked by raising the temperature of the barn for a time to 120° F. or more. He suggests that this method "probably acts rather by killing the leaf tissue than by injuring the fungus, which the temperatures reached would be quite unlikely to do." The development of the parasitic fungus is consequently checked, since it does not readily grow on dead materials.

In June, 1932, experiments were carried out in the Mareeba district by Mr. N. E. Goodchild, Instructor in Agriculture, at the suggestion of the writer, to test out this method.

In these experiments, two barns were used. One was kept at low temperatures and high humidity for the purpose of colouring the leaf, and the other was used for preliminary heating of the leaf prior to colouring. The temperature of the latter was first raised to 120° F. at the rate of one degree per minute. Sticks of leaf were exposed to this and higher temperatures up to 160° F. for various periods of time. After treatment the leaf was transferred to the colouring barn and coloured in the usual manner. For comparative purposes, some leaf was placed directly into the colouring barn without preliminary heating.

In the first experiment the temperatures used were 120° F., 130° F., 140° F., 150° F., and 160° F., and the periods of exposure varied from five to fifty minutes. It was found that the control leaf showed larger

and more numerous spots than that which had been subjected to a preliminary heating. The latter, however, was mostly scorched, and spotting developed to some extent.

In the second experiment efforts were made to raise the temperature more rapidly, to observe the effect of times of exposure other than those employed in the previous experiment, and also to confirm the results already obtained.

The greatest speed by which the temperature could be raised was 3° F. per minute. The same temperatures were used as above, and the period of exposure varied from one to twenty minutes.

It was found that five minutes' exposure at 130° F. gave rather good control, although the tips of the leaves were scorched. Ten minutes at this temperature was definitely too long, since the exposed portions of leaves were damaged. Scorching occurred at and above 140° F. when exposed for only three minutes or less.

From these experiments it was concluded that barn spotting could be controlled to some extent by this method, but that the danger of ruining the leaf by over-heating was too great to warrant its recommendation as a general control measure.

The following season further curing experiments along different lines were carried out. The principles involved were based upon the results of laboratory investigations. These studies and the subsequent curing experiments are discussed herein in some detail. It must be remembered, however, that the following is a progress report of preliminary work and that further investigations are contemplated.

LABORATORY EXPERIMENTS.

The two main factors involved in flue curing of tobacco are temperature and humidity, and both these factors may be controlled during the process. Hence laboratory experiments were designed to study the effect of variations of temperature and humidity on the growth of the fungus, which is the cause of frog eye, and on the development of spots on affected leaf tissue.

Temperature Reactions of C. nicotianae and Their Possible Significance in Spot Development.

Single spores of the fungus *Cercospora nicotianæ* were isolated from frog eye spots on tobacco leaves, and were grown on potato dextrose agar medium for the purpose of these investigations. Cultures obtained in this manner were incubated in fourteen compartments of a multiple temperature incubator at temperatures ranging from 5° C. to 37·5° C., at intervals of about 2° C. It was observed that the appearance of the fungus varied greatly at different temperatures. Striking differences were noted in the colour of the fungus, the nature of its growth, and the formation of vivid coloured zones.

Since temperature can be responsible for such variations when the fungus is grown on artificial medium, it seems quite likely that it would also cause variations in colour when the fungus is growing within a tobacco leaf.

Barn spots are usually brown, but at times they may be a greenish-black. Butler[1] has suggested that this unusual form may be "due to the special conditions of temperature and the like in the barns."

Furthermore, Hopkins[3] has recently reported that in Rhodesia the symptoms of frog eye leaf spot, which developed in the field in 1933, were abnormal, and attributes this phenomenon to "unfavourable weather conditions with which the crop had to contend." Similar variations of symptoms have at times been observed in Queensland. The above observations tend to support the possibility that temperature is at least one factor which may cause variations in the colour of leaf spots.

The effect of temperature on the growth of the fungus is graphically illustrated in Plate 31.

These temperature studies have indicated that *C. nicotianæ* will not grow on potato dextrose agar media at temperatures below approximately 7.5° C. (45.5° F.) or above 34° C. (93° F.), and that the optimum temperature for its development is about 26° C. (78.8° F.).

The upper limit of temperatures for growth (i.e., 93° F.) is particularly significant in an investigation of the development of barn spot during curing. Spotting has been observed to occur during flue curing when the temperature at the lower tier in the barn did not fall below 95° F. Nevertheless, under the conditions of the experiment reported above, the fungus which is the cause of this disease does not grow on artificial media at temperatures even slightly lower than 95° F. Possibly the temperature within the tissue of tobacco leaf in a barn differs from that of the surrounding air, or other conditions within the barn are such as may allow growth of the fungus at temperatures apparently above the maximum limit, and this may subsequently result in the development of barn spots.

On the other hand, it is likely that the fungus does not actually grow at all during the curing process. Spotting probably is due to infection which has occurred in the field, although development then has not advanced sufficiently to produce a spot which is clearly visible to the naked eye. Such tissue which has already been affected by the parasite may turn brown when the cells of the normal tissue are colouring and the leaf is being dried; consequently barn spotting would become apparent during this period.

Relative Humidity and the Development of Barn Spot.

In these experiments the relative humidity of an atmosphere was regulated by exposing a surface of distilled water or of various mixtures of water and sulphuric acid within a closed vessel, which contained the leaf tissue or culture being studied.

The effect of various relative humidities obtained in this manner on the growth of the fungus was first investigated. Cultures of *C. nicotianæ* were grown at a constant temperature in atmospheres which varied from 85 per cent. humidity to 100 per cent. humidity, but no significant difference in the rate of growth was observed.

Subsequently the development of barn spot lesions on tobacco leaf tissue was similarly studied.

Tobacco leaf, at various stages of maturity, showing frog eye lesions was obtained from the Sarina district. On arrival at Brisbane the leaf was cut into 4-inch squares, and the number of diseased spots in each square counted, and the limits of several marked with Indian ink.

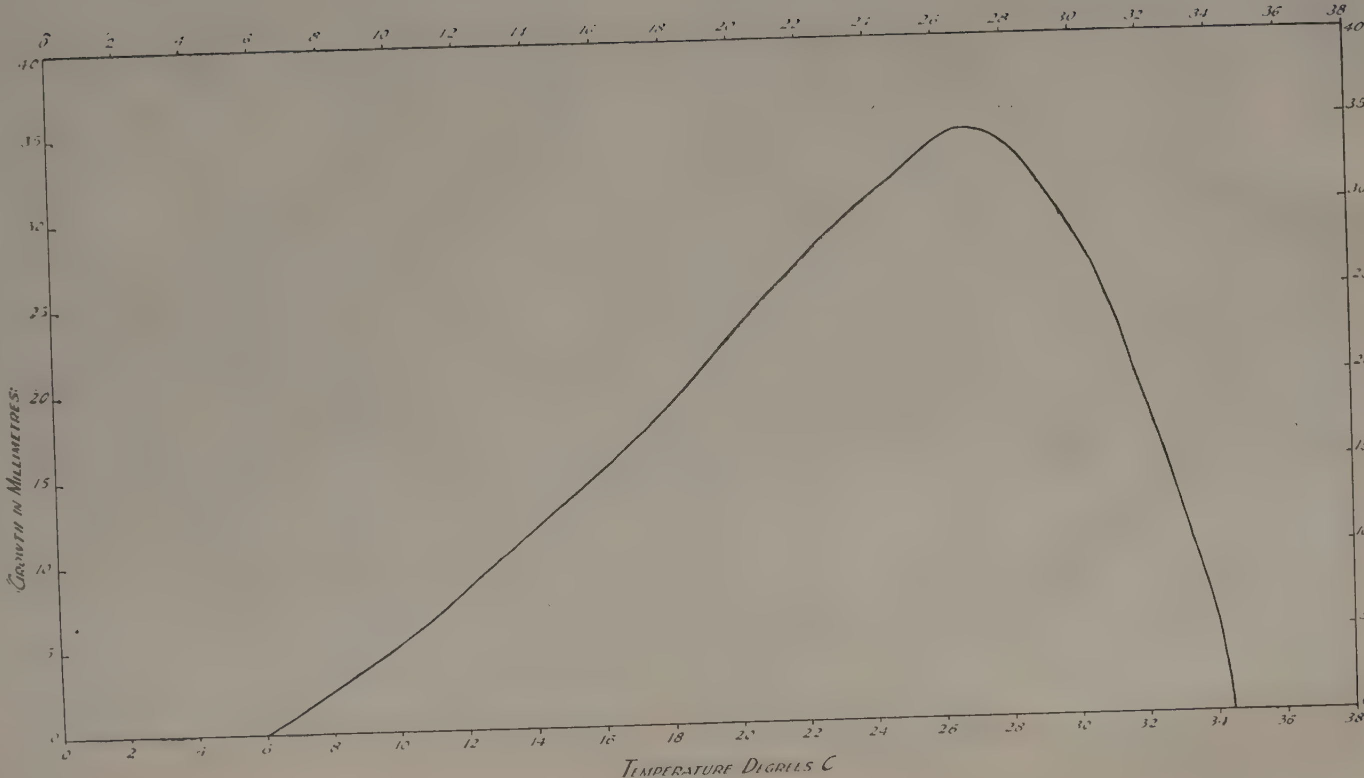

Plate 31.

Growth-temperature curve for *C. nicotianæ* after nine days' incubation. Averaged from data obtained from two series of experiments.

The leaf tissue was suspended in paper saddles in jars containing atmospheres adjusted to the required humidities. The relative humidities used were approximately 60, 70, 80, 90, and 100 per cent. The jars and leaf were placed in an incubator at 43° C. (109° F.).

The leaf was examined after forty hours. It was then found that fairly extensive development of spots had occurred at all humidities with over mature leaf. Some spots had coalesced, and large brown areas had developed, which made the actual measurement of the extensions of spots difficult.

With less mature leaf it was found that the rate of development of the spots varied at different humidities. The average increases in diameter of the spots measured were as follows:—

At a relative humidity of 60 per cent. the increase was 3·0 mm.

At a relative humidity of 70 per cent. the increase was 3·5 mm.

At a relative humidity of 80 per cent. the increase was 3·0 mm.

At a relative humidity of 90 per cent. the increase was 4·7 mm.

At a relative humidity of 95 per cent. the increase was 5·4 mm.

At a relative humidity of 100 per cent. the increase was 4·1 mm.

It will be noted that a development occurred in all cases, but this development was greatest when the relative humidity exceeded 80 per cent. The development in a saturated atmosphere, however, was less than that at 90 per cent. relative humidity. The relative humidity of the atmosphere in a curing barn varies from about 86 per cent. to 96 per cent. during the early stages of curing; consequently these observations suggested that further investigation into the development of barn spotting at high relative humidity might be of practical importance.

At a later date, further leaf from the same source was obtained, and the experiment was repeated. The humidities used were 60, 80, 90, and 100 per cent. On this occasion, however, the leaf was incubated at a temperature of 34° C. (93° F.), since this more closely approximates the temperatures which obtain during the early stages of curing.

The leaf was examined after seventy-five hours, and it was found that the average extension of about thirty spots in each series was as follows:—

At a relative humidity of 60 per cent. the increase was nil.

At a relative humidity of 80 per cent. the increase was 0.5 mm.

At a relative humidity of 90 per cent. the increase was 1·2 mm.

At a relative humidity of 100 per cent. the increase was 0·3 mm.

In this case the development at 90 per cent. relative humidity was four times as great as that which occurred in a saturated atmosphere.

Discussion.

No great degree of exactness can be expected in experiments of this nature, since firstly the leaf material used varied in amount of infection and age, and secondly a considerable period elapsed from the time the leaf was harvested until it arrived in Brisbane. Nevertheless, the results indicated that (1) the more mature the tissue the more liable it was to the development of barn spots; (2) this development varied directly up

to a certain point with the relative humidity of the atmosphere in which the leaf was coloured; and (3) the greatest development of spotting occurred when the relative humidity of the atmosphere was at some point between 90 and 100 per cent., but decreased as the relative humidity approached saturation point.

The results of this preliminary work were encouraging, since they indicated that high relative humidity might to some extent check spot development. From the practical viewpoint this was important, since control methods involving a variation of relative humidity during curing would probably be less apt to cause injury to the leaf than one depending on extremely high temperatures.

FLUE-CURING EXPERIMENTS FOR THE CONTROL OF BARN SPOT.

During the past season, at the suggestion of Mr. J. H. Simmonds, Plant Pathologist, flue-curing experiments were carried out in the Sarina district in order to test the significance of the results which had been obtained from the preliminary laboratory experiments reported above. These experiments were made in conjunction with other duties, and consequently the time available was limited. Hence in these experiments, in order to rapidly test the available data, both temperature and humidity were appropriately regulated. Even so, it was only possible to carry out two series of experiments. Since some rather promising results were obtained, they will be discussed herein in detail.

As the conclusions are based on somewhat limited data, it will be necessary, however, to confirm these results during the coming season.

First Curing Experiment.

Since laboratory experiments had indicated (1) that the maximum temperature for growth of *Cercospora nicotianæ* in culture was in the region of 93° F., and (2) that the development of spots on tobacco leaf tissue was restricted in a saturated atmosphere, efforts were made during this experiment to colour the leaf at a temperature range above 95° F., and also to maintain as high a relative humidity as possible within the barn during this period.

Through the courtesy of Messrs. Gerry and Brooks, of Sarina, two of their 12 feet by 12 feet flue-curing barns and the required amount of harvested tobacco leaf were made available for the experiment. Useful advice and practical co-operation were rendered by Mr. C. S. Clydesdale, Senior Instructor in Agriculture, during the curing of these barns, and his efforts were greatly appreciated.

Since it was anticipated that "sponging," a blemish associated with variations in humidity during curing, might develop with leaf cured in an abnormally high relative humidity, the barns were not overloaded with leaf. Only five tiers were used, and the sticks were spaced so that no more than twelve sticks of leaf were hung in each row. Other precautions were also taken at the end of the yellowing period to avoid the development of this trouble.

The barns were filled with leaf by about 5 p.m. on 5th May, and curing operations commenced at 9 p.m.

The leaf in one barn (the control barn) was cured in the usual manner for comparative purposes, and that in the other was subjected to the high temperatures and relative humidity discussed above.

Details of Relative Humidity and Temperature.

In order to increase the relative humidity of the atmosphere within the experimental barn, steam was generated in a 40-gallon iron drum and led into a tub of water in the barn. Wet bags were also periodically placed on the hot flue pipes in the barn. In this manner it was hoped to colour the leaf in an actually saturated atmosphere. It was found impossible, however, to maintain saturation with the facilities available.

A 100 per cent. relative humidity was obtained in this barn during the first half hour and also on two other occasions during the first twelve hours, but could not be maintained for any length of time. The relative humidity exceeded 95 per cent. for only one and a-quarter hours during this period.

That of the control barn did not exceed 92 per cent. during the first twelve hours, and was slightly lower on the average.

For the remainder of the colouring period efforts to maintain a saturated atmosphere in the experimental barn were more successful.

During the same period the relative humidity of the control barn did not exceed 96 per cent., and exceeded 93 per cent. for only two hours, which was about 9 per cent. of the time under discussion.

While the leaf was colouring the temperature of the experimental barn fluctuated between 94° F. and 103° F., whereas that of the control barn varied between 85° F. and 96° F.

The temperatures and relative humidities which were recorded in these two barns during this period are shown by the graph in Plate 32.

Operations Subsequent to Curing.

The ventilators of the experimental barn were opened twenty-eight and a-half hours after curing commenced, whereas those of the control barn were cracked after thirty-three hours. Hence the higher relative humidity and temperature of the former apparently accelerated the colouring process by about five hours.

The moisture in the experimental barn was expelled as rapidly as possible at the termination of the colouring process, as a precaution against the development of "sponging." At Mr. C. S. Clydesdale's suggestion, when the leaf was sufficiently coloured the temperature was rapidly raised 5° F., the top ventilators were opened wide and the lower ventilators were half opened for forty-five minutes. Consequently, the relative humidity was lowered from 96 per cent. to 51 per cent. during the first four minutes, and eventually to 49 per cent. At the termination of this period the top ventilators were closed to a third and the bottom ventilators to a quarter, and the curing was continued in the usual manner.

Observations on Barn Spot Development.

Barn spotting was observed to develop in both barns after about twelve hours' curing, and subsequently increased in severity, and was very obvious seven hours after the ventilators were opened. During the first twenty-four hours, however, spotting did not appear to be so severe in the experimental barn as in the control barn.

At the termination of the experiment there was no marked difference in the amount of spotting which had developed on the leaf from either barn. Nevertheless, it was considered, after a careful examination, that the leaf from the experimental barn was slightly less spotted than that

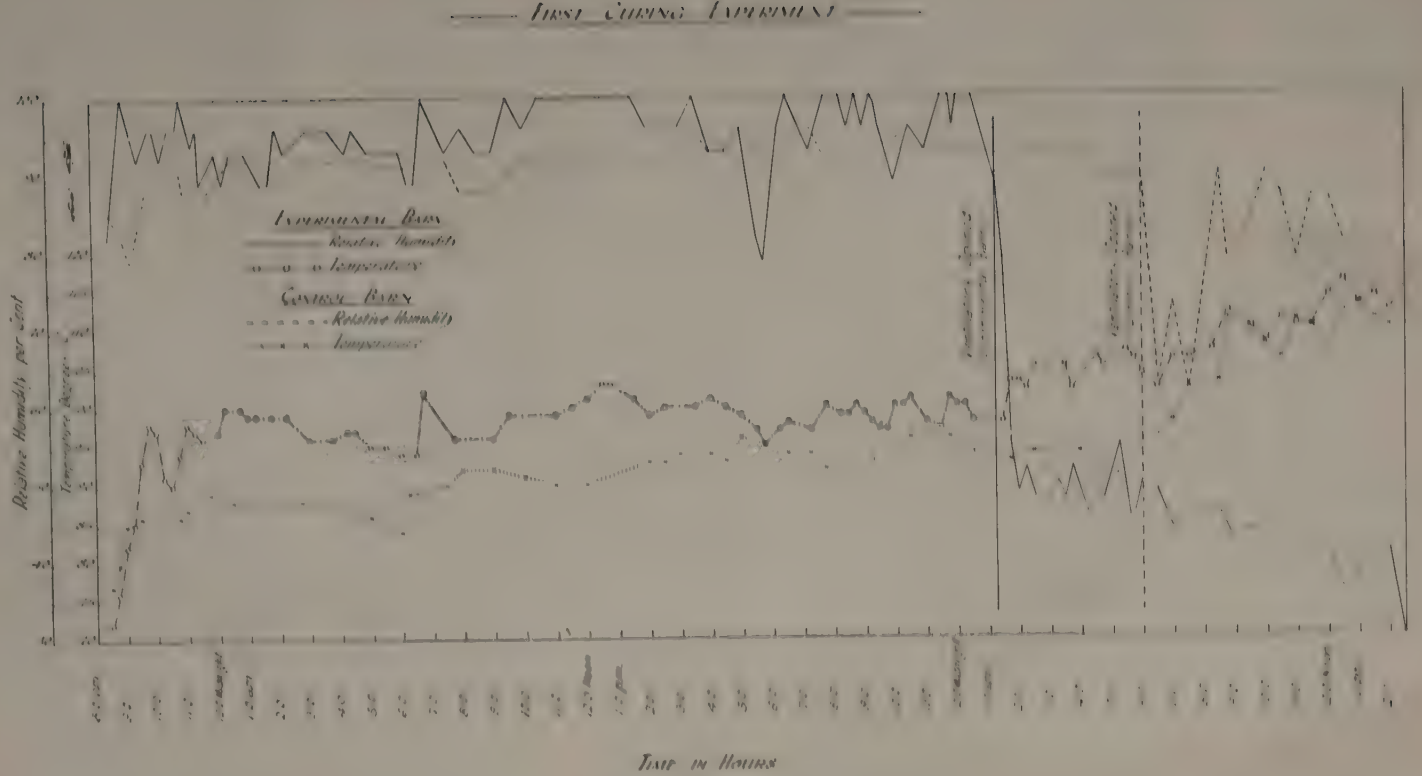

PLATE 32.

First curing experiment. Graph showing relative humidity and temperature records obtained in both the experimental and control barns during the period when leaf was colouring.

from the control barn, and the colour of the leaf was brighter and showed less "sponging." During the experiment several faults were detected in the construction of the barn, which made it extremely difficult to maintain a high degree of humidity. Consequently, it was considered that in view of the conditions under which the experiment was carried out, the results were slightly promising, and warranted the repetition of the experiment.

Second Curing Experiment.

On 8th June the experiment described above was repeated. Besides one experimental and one control barn, in which careful records of temperature and humidity were made, a third barn of leaf was cured normally at the same time, the final result only in this case being observed. On this occasion special precautions were taken to render the experimental barn as air-tight as possible prior to the commencement of the experiment. The facilities for the generation of steam were the same as employed previously.

The thermometers were suspended from the lower tier, and the leaf hung on this tier was carefully graded and labelled prior to curing. Five grades were recognised—namely, clean leaf, which showed no readily observable spots by reflected light; slight infection, when leaves contained one or two spots; light infection, when four or five spots were noticed; medium infection, when about twenty spots were present; and, finally, heavy infection, when numerous spots were apparent. Some leaf graded in this manner also showed incipient frog-eye lesions as minute spots when viewed by transmitted light.

Details of Relative Humidity and Temperature.

After the first three hours of curing, the temperature of the experimental barn did not fall below 98° F. during the colouring process. The maximum temperature reached was 108° F. On the average the temperature for this period was a little over 100° F. The temperature of the control barn varied from 82° F. to 100° F., and on the average was about 10° F. lower than that of the experimental barn.

A saturated atmosphere was obtained on twelve occasions during the first twenty-four hours in the experimental barn, and was maintained for periods up to two and a-half hours. The relative humidity only fell below 90 per cent. on two occasions, and then for periods of less than a quarter of an hour. The relative humidity was either at or above 96 per cent. continuously for fourteen hours during the first twenty-four hours of curing, except for one period of half an hour and another of forty-five minutes. This degree of relative humidity was maintained for ten and a-half hours of the first twelve hours of the experiment.

The relative humidity varied from 85 per cent. to 96 per cent. in the control barn during the first twenty-four hours. It did not exceed 96 per cent., and only maintained that registration for half an hour during this period. It was above 92 per cent. for eleven and a-half hours, and two-thirds of this time was recorded during the first twelve hours of the experiment.

Temperature and relative humidity records for this experiment are illustrated by graphs in Plate 33.

The leaf coloured more rapidly in the experimental barn than in the control barn, and the ventilators of the former were cracked ten hours sooner than those of the latter.

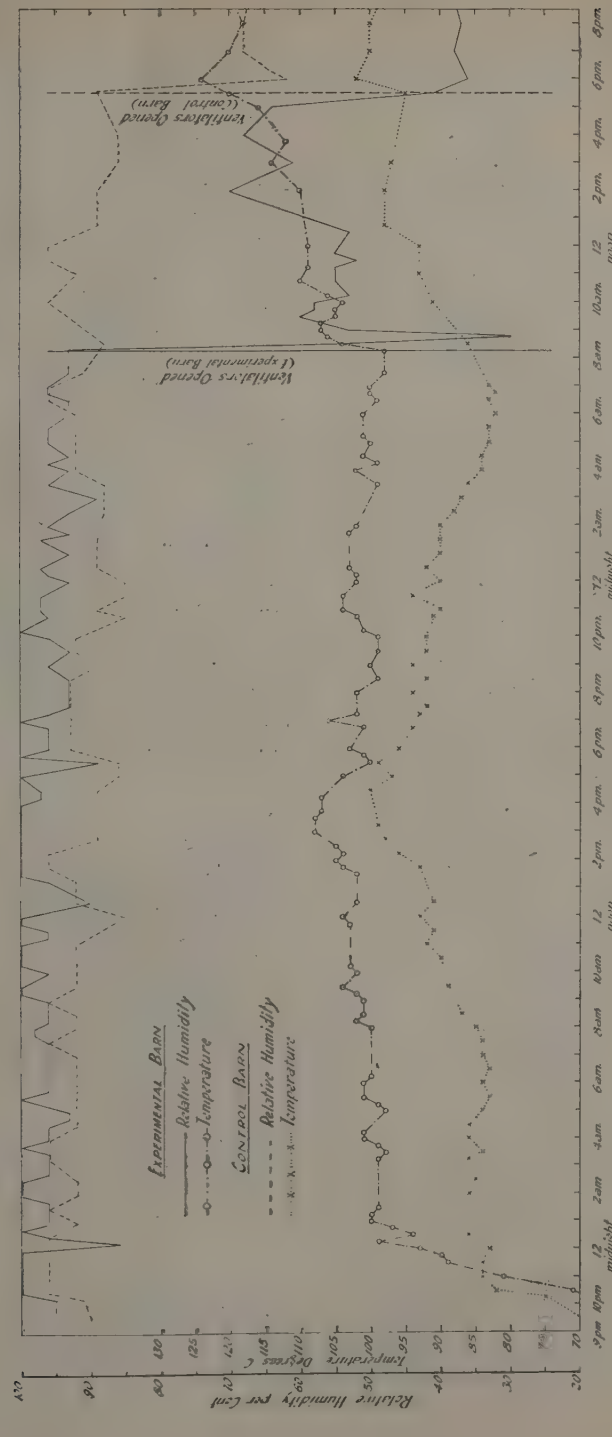

Plate 33.

Second curing experiment. Graph showing data similar to Plate 32. The development of barn spot in the experimental barn in this case was considerably retarded.

Although special precautions were taken to make the experimental barn as air-tight as possible, it was found extremely difficult to maintain a sufficiently high percentage of relative humidity with the steam generating apparatus used. It will probably be found necessary in future, therefore, to employ some type of portable boiler for this purpose.

Observations on Barn Spot Development.

As in the previous experiment some barn spot development was observed in both barns after about twelve hours' curing.

When the leaf had been cured, it was found that that from the experimental barn was obviously less spotted, and the spots usually showed less development than leaf from the control barn, or from the third barn in which leaf was also cured in the manner usually practiced. Furthermore, less "sponging" occurred in the experimental barn.

Leaf which was clean, or slightly or lightly spotted prior to curing in the experimental barn developed only a few small spots in some cases, and mostly showed no development (Plate 34). Similar leaf from the control barn was mostly moderately to heavily spotted, although some leaves were unblemished at the termination of the experiment. The latter were probably not affected with the disease when harvested.

Leaf which showed medium infection prior to curing developed more spotting in the control than in the experimental barn. About 70 per cent. of this leaf was finally moderately to heavily spotted in the control barn as compared with about 50 per cent. moderately spotted in the experimental barn.

No great difference could be observed in the final condition of leaf which was heavily spotted prior to curing, although that from the experimental barn was slightly superior.

Hence quite a striking improvement was obtained with leaf cured in the experimental barn, which had less than about half a dozen spots apparent prior to curing. With leaf which was originally more heavily spotted the improvement was not so marked. This striking contrast was made possible by the fact that environmental conditions were particularly favourable at the time of the experiment for the development of the disease.

Since the temperature varies considerably at different heights in a barn during curing, a comparison was also made of the amount of spotting which had developed on leaf from various tiers in each barn. No obvious difference, however, could be observed in either case.

Discussion of Results of Curing Experiments.

As has been pointed out elsewhere, this work was of a preliminary nature; nevertheless, since the results obtained in the final experiment were rather striking, it is considered that it may be beneficial to analyse that data which is available.

Five important factors were involved in the experiments under discussion—namely, the condition of the leaf used, the rapidity with which the leaf was dried out after colouring, the time taken to colour the leaf, and the temperature and the relative humidity which obtained in the barn during the colouring process.

A. B.

PLATE 34

Two tobacco leaves cured during the second curing experiment. Both showed "light" frog-eye infection (i.e., four or five spots) prior to curing.

A. Cured leaf from control barn, showing extensive development of barn spot.

B. Cured leaf from experimental barn, showing very little development of barn spot. Leaves which were clean or "slightly" spotted developed even less barn spot in this experiment.

The first is of no importance since similar leaf was used in both control and experimental barns. Furthermore, it is hardly likely that the outstanding results of the second experimental barn were entirely due to the unusual rapidity of drying the leaf after colouring. The temperature of this barn was 130° F. with a relative humidity of 30 per cent. twenty-seven hours after the ventilators were cracked, whereas the control barn reached a temperature of 133° F. with a relative humidity of 26 per cent. in twenty-nine hours—i.e., only two hours longer. Moreover, a graph showing the relative humidity of the two barns illustrates that the slope of that of the control barn is steepest, and hence that during some of this period at least the leaf was drying more rapidly in the control barn than in the experimental barn.

The combination of high humidity and high temperature within the experimental barns certainly accelerated the colouring of the leaf—namely, by four and a-half hours in respect to the control barn in the first, and ten hours in the second experiment. It will be noted, however, that the actual times for colouring were—Test barns twenty-eight and a-half hours and thirty-four hours, control barns thirty-three and forty-four hours, respectively. The longer periods taken in the second series were due to the fact that they were carried out late in the season, when cool weather was being experienced. It would seem from these figures, therefore, that spotting was not avoided in the experimental barns by rapidity in colouring. Although the experimental barn in the second series coloured the leaf ten hours quicker than the control barn, the actual period taken was thirty-four hours, which was in fact one hour longer than the time taken by the control barn in the first series, when considerable barn spotting occurred.

The temperature of the second experimental barn was considerably higher than those of either of the control barns. It was also, on the average, a few degrees higher than the temperature of the first experimental barn, and for a period of one and a-half hours was 7° F. or 8° F. higher. Consequently, since the second experimental barn was much more successful than the first, temperature may have been the limiting factor. Such is hardly likely, however, since during curing the temperature of the top tier may vary by about 10° F. from that of the bottom, and hence a considerable range of temperatures obtains within a barn. It was not possible, with the facilities available, to take temperature readings at various heights during these experiments, but it would be likely that the temperature of the coldest portion of the second experimental barn would be lower than that of the warmest portion of the first experimental barn for a considerable period. Hence if the temperatures reached during these experiments were responsible for the results obtained, then better results would have been observed in some tiers in the first experimental barn, or the amount of spotting would have varied considerably with leaf from different levels in the second experimental barn. Such, however, was not the case.

The most likely reason for the better control of spotting obtained with the second experimental barn was probably the high relative humidity which was maintained when the leaf was colouring, especially during the initial stages of the process. As has been indicated above, the relative humidity of the second experimental barn was either at or above 96 per cent. practically throughout the first twelve hours of curing, whereas that of the first experimental barn only exceeded 95 per cent. for one and a-quarter hours during this period.

The percentages of relative humidity which were recorded in the four barns under discussion for the first twelve hours of curing have been critically analysed, and the total times that the leaf was exposed to various humidities have been grouped together, in each case, and are graphically depicted in Plate 35.

It will be noted that the leaf in the second experimental barn was exposed for much longer periods for all relative humidities in excess of 95 per cent. than that of the first experimental barn, as is illustrated by the difference in the heights of the two columns. The differences are even more striking when the relative humidity of the second experimental barn is contrasted with that of the two control barns for the same period.

It therefore appears reasonable to believe that the difference in relative humidity may have been the main factor responsible for the better results obtained in the second experimental barn.

Further investigations will be carried out to determine the effect of high relative humidities on the development of barn spot. Should this prove to be the limiting factor, it will then be desirable to ascertain the minimum percentage of relative humidity permissible in a barn during the colouring process or for any part of it, to most effectively control the development of spotting.

If the results obtained from these proposed experiments are satisfactory, then it should be possible to make definite recommendations for the control of barn spotting by variations of curing methods as practised at present.

Summary.

Barn spot of tobacco is caused by *C. nicotianæ*, and develops during the tobacco-curing process.

When tobacco leaf was heated to about 130° F. the development of barn spot was controlled to some extent, but the danger of ruining the leaf by over-heating was too great to warrant the recommendation of this procedure for general use.

The nature of the growth of *C. nicotianæ* varies considerably when grown on artificial media at different temperatures.

The optimum temperature for its growth on potato dextrose agar was found to be approximately 26° C. (78·8° F.). The minimum and maximum temperatures for growth were 7·5° C. (45·5° F.) and 34° C. (93° F.) respectively.

Since barn spot may develop during the curing process at temperatures greater than 93° F., it is considered likely that barn spot is not the result of growth of *C. nicotianæ* during curing, but is due to the reaction at this time of cells which have been affected by the parasite in the field.

No significant difference was observed in the growth of *C. nicotianæ* on artificial medium when grown in atmospheres of various relative humidities.

It was found that the more mature the tobacco leaf tissue, the more liable it was to the development of barn spot.

Humidity studies indicated that the development of barn spot varied, up to a certain point, directly with the relative humidity of the

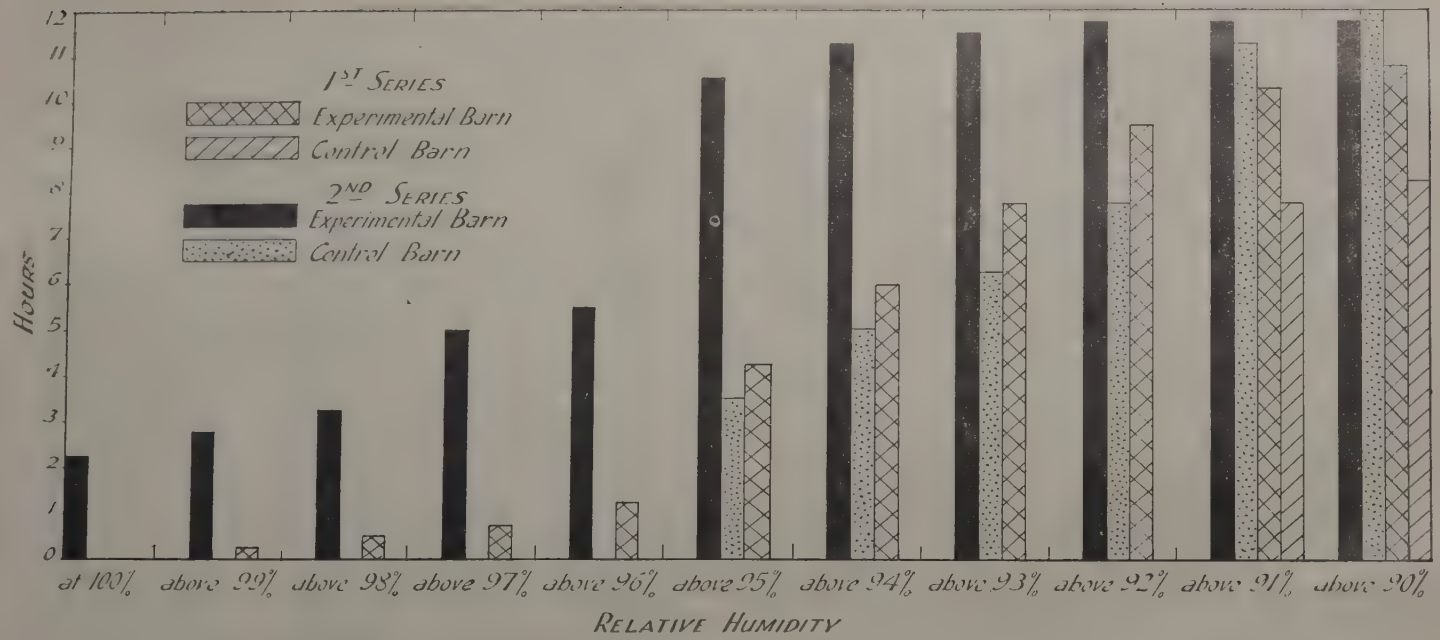

PLATE 35.

Diagram showing the periods for which tobacco leaf was exposed to various humidities during the first twelve hours of the curing experiments.

It will be observed that the relative humidity within the experimental barn in the second series was above 95 per cent. for a much longer period than was the case with the other three barns.

atmosphere in which the leaf is coloured. The development was less in a saturated atmosphere, however, than when the relative humidity was 90 per cent.

Two flue-curing experiments were carried out with commercial curing barns in the Sarina district.

Difficulty was experienced in maintaining a high percentage of relative humidity with the facilities available.

In both experiments the colouring process was considerably accelerated, and the leaf was not adversely affected by the increased humidity and temperature of the barns.

In the second experiment the temperature in the experimental barn varied from 98° F. to 108° F., and the relative humidity of the atmosphere was either at or above 96 per cent. for fourteen hours during the first twenty-four hours of curing.

Leaf cured in this barn developed considerably less barn spot than similar leaf cured in the usual way.

It is considered, tentatively, that the most likely reason for this result was the high relative humidity which was maintained when the leaf was colouring, especially during the initial stages of the process.

It is proposed to carry out further experiments along these lines.

Acknowledgments.

Acknowledgment is made to Mr. J. H. Simmonds, Plant Pathologist, Department of Agriculture and Stock, Queensland, for the active interest shown and useful suggestions made in connection with this work, and to Messrs. Gerry and Brooks, Sarina, for the pathological specimens supplied, and for personal assistance and flue-curing facilities at Sarina.

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The Cultivation of the Peanut.

By N. A. R. POLLOCK, Senior Instructor in Agriculture.

Description.

THE Peanut, *Arachis hypogeia*, also known frequently as the earth or ground nut, is a plant of annual habit, belonging to the natural order Leguminoseæ or pod-bearers, and in common with most other members of the pea family has the power of obtaining its nitrogen supply from the atmosphere and storing it up in nodules on the roots.

Unlike other legumes, excepting the Bombarra ground nut, *Voandzeia subterranea*, and one or two others, this plant, while blooming above ground, matures its pod or fruit under the surface of the soil. The yellow flowers are borne at the joints where the leaves are attached to the stem, in the bunch or upright varieties at the base of the plant, and in creeper or procumbent varieties right along the stems. Upon pollination taking place the flower fades, and falling off leaves the stalk with a thickened pointed end called the "peg" or "point," which grows down into the soil, where it matures into the pod or so-called nut. It is apparent from this that the soil on which the crop is grown should be of a soft or friable nature or such that a loose surface can be easily maintained.

Range.

The peanut can be grown over the whole of Queensland, and while in the cooler parts it only succeeds in summer, in the tropical portions it may be grown at any period of the year where a sufficiency of rain falls.

The period of growth ranges according to variety and climate from fifteen to twenty weeks, the longest period being taken up by the creeper or procumbent varieties.

A moderate rainfall, plenty of sunshine, and a comparatively high temperature best suit the crop, and departures from these may result in a more lengthened period of growth. The crop can also be grown under irrigation.

Soils.

The nature of the soil on which the crop is grown, besides its fertility, is the main factor in a profitable crop. A loose texture is desirable to allow the pegs to easily penetrate and expand to form the pods and mature evenly, as well as to permit of easy harvesting in freeing the nuts from the soil. Good drainage is also essential, more especially when a heavy rainfall is liable to occur during the growing period.

Light sandy loams with a good humus content are best adapted for the production of peanuts for sale as whole nuts, since the shells, being clean and bright, are more attractive.

Soils in which the percentage of iron is high and those of clayey nature are apt to produce stained or dirty shells, and though the berries or peas may be of equal or even superior quality, the discoloration is calculated to prejudice sale. When, however, the product is sold in the shelled condition, as to confectioners, this defect is of minor consideration. Ill-drained, heavy clays and soils which become hard and compact should be avoided.

A suitable mechanical character is the first essential in a soil for peanuts, as fertility can be improved by the judicious use of manures and a proper system of cropping.

Depth of Soil.

A soil of a foot or upwards in depth is to be preferred, especially in districts of abundant rainfall, but lesser depths down to 8 inches, provided the subsoil is of a porous nature, will allow of successful production.

Preparation of the Soil.

As the success of the crop is in large measure dependent on the tilth maintained during growth, it is important that the preparation of the soil prior to planting should be thorough.

In the case of virgin soil or land that has been under pasture and where the roots of the preceding crop have not been disturbed, it is desirable to plough a considerable time before sowing is contemplated, in order that any growth ploughed under as well as fibrous roots will have time to decay.

Where this has been effected or a previous crop has left the land clean, a ploughing three or four weeks before the time of planting with an immediate harrowing to create a good tilth and to conserve moisture is desirable. Periodic harrowing during these weeks while further promoting tilth will destroy weeds as they germinate and permit of sowing in a clean seed-bed.

Depth of Ploughing.

As a general rule, the depth of ploughing should not be as great as for potatoes or maize in the same locality. From 5 to 6 inches is regarded as adequate, but deeper ploughings, provided no subsoil is brought to the surface, are not regarded as detrimental.

Fertilizers and Lime.

In common with other legumes, the peanut thrives best in a soil in which there is a sufficiency of lime. Not all soils require the addition of lime, but most soils in districts subject to heavy rainfall, and which give an acid reaction, will benefit by an application of from 5 to 10 cwt. of stone lime or 10 to 20 cwt. of earthy lime or pulverised limestone to the acre, broadcasted (not ploughed in), preferably a week or more before applying commercial fertilizer and sowing the seed. The cultivation of the crop will sufficiently work this lime into the soil. Where any doubt exists as to the necessity of applying lime to the soil, a portion should be limed and the resultant crop compared with a similar area unlimed.

In applying manures for the crop, care should be taken to only apply organic manure in a well-rotted condition, and then only in small quanties and thoroughly mixed with the soil. Larger quantities of fresh manures will result in many of the pods being poorly filled. These poorly-filled pods are known as "pops" or "duds."

Organic manures such as that from the farmyard are better applied for a previous crop. Where growing crops are ploughed in to augment or maintain the supply of humus, it is also better to grow an intervening crop.

The supply of humus in the soil is of great importance to all crops, as not only is the soil mechanically benefited but it preserves a more even temperature and is more retentive of moisture. Bacterial multiplication is also assisted and the supply of plant food improved.

As the peanut is a legume and draws much of its nitrogen from the air this element is not called for in great quantity in the fertilizer, especially when the soil is fairly well supplied with humus and decaying organic matter. On most soils, however, its presence in immediately available form is desirable to allow the plants to become well established.

Phosphoric acid and potash are the chief elements demanded in the fertilizer mixture, of which the rate of application will be determined by the natural fertility of the soil.

An ample supply of phosphates in the soil stimulates root development and causes the crop to mature more rapidly and evenly. It is also necessary to allow the nitrogen-fixing bacteria to assume the motile form and thus to become capable of invading the young roots.

On loamy soils, such as those in which maize and potatoes return profitable crops, the necessity for applications of fertilizer is not urgent, yet a supply in small quantity can be calculated to induce a greater profit. On such soils, however, the fertilizer should containly only a small percentage of nitrogen, and this in a readily available form.

A mixture of 10 lb. nitrate of soda or sulphate of ammonia, 70 lb. high-grade superphosphate, and 20 lb. sulphate of potash for each 100 lb. would be considered suitable. This mixture would contain 1·5 per cent. nitrogen if nitrate of soda was used, or 2 per cent. nitrogen if sulphate of ammonia was used; the percentage of phosphoric acid would be 14·35 and that of potash approximately 10. Such a formula might be expressed as 2-14-10.

On poorer soils, and especially those of sandy character, recommended for the production of bright tobacco, in which the humus content is generally low, the application of a fertilizer carrying a somewhat higher percentage of nitrogen is desirable.

On sandy loams a mixture of 20 lb. sulphate of ammonia, 60 lb. high-grade superphosphate, and 20 lb. sulphate of potash would be suggested.

On sandy soils a mixture of 15 lb. dried blood, 13 lb. nitrate of soda, 60 lb. high-grade superphosphate, and 12 lb. sulphate of potash would be more advisable, as the organic matter of the dried blood would be of assistance and its nitrogen content become readily available when the nitrate was exhausted. This latter mixture is the popular 4-12-6 tobacco mixture. The former would be expressed as 4-12-10 and the first named as 2-14-10, the numerals in their order representing percentages of nitrogen, phosphoric acid, and potash respectively.

When the drills are 3 feet apart, a collective length of 220 chains constitutes an acre, and when 2 feet 6 inches apart such collective length would be 264 chains.

Dressings of fertilizer from half a pound per chain at the rate of 110 lb. and 132 lb. respectively per acre would be suggested on a fairly fertile sandy loam, up to 2 lb. per chain or 440 lb. and 528 lb. respectively on a poor sandy soil. Generally, however, a dressing of 1 lb. per chain of drill should be ample.

On certain fertile soils applications of superphosphate only at the rate of half a pound per chain of drill might be sufficient.

Commercial fertilizers are usually applied immediately prior to planting a crop, and as the roots of the peanut do not spread to any distance, the application in the drill with a fertilizer distributor having one or two tines at the back will greatly aid in mixing the fertilizer with the soil.

Ashes from the forest hardwoods, which contain lime and potash, are useful, and may be applied to the soil broadcast in a similar manner to lime at the rate of about 10 cwt. to the acre. These ashes, however, should not previously have been exposed to rain, as then a great deal of their value will have been lost. The ashes of soft woods growing in the scrubs are not considered so good.

Selection of Seed.

As with other crops, in order to secure the best results it is essential that the seed of the peanut should be of the highest grade. Poor seed cannot be expected to yield a good return. In the first planting, seed should be secured from a heavy producing crop and subsequently carefully selected in the field from the heaviest producing plants of the required type. A good plan is to select the nuts from the best producing plants and sow these in a special seed patch, each year selecting the best of this area for next year's seed patch. Nuts harvested for seed should be fully matured, handled carefully, and not picked from the plants for several weeks after curing; they should then be picked by hand and the selected ones thoroughly dried and stored in a dry place free from mice or insect attack. Storage in tanks in a similar manner to maize is most satisfactory.

Quantity of Seed.

The quantity of seed required to plant an acre is about 40 lb. of the whole nuts and from 25 to 30 lb. of whole nuts shelled, varying slightly according to the weight of the nut and the distance apart they are planted. Some growers use as much as 60 lb. per acre of the large podded varieties. It is interesting to note that the whole nut, when planted, provides but one plant, but if shelled and the kernels planted apart, two plants will result.

Time of Sowing.

According to the climates of the various districts, so will the time for planting vary.

In the cooler districts, sowings may be made when all danger of frosts is over and the soil can be expected to be reasonably warm, September, October, November, and December being suitable months. In the tropics the crop can be grown practically throughout the year, but consideration must be given to climate and rainfall—i.e., sufficient rainfall should be obtained to grow the crop and fine weather be expected at harvest time.

In the tropical portions of the State, where the monsoonal rain or wet season commences in December, the main crop is sown in January, February, and March, according to the likelihood of reasonably fine weather in the months of April, May, and June or July, when harvesting should occur.

In planting large areas it is recommended to spread the sowings over such a time as will allow of harvesting one lot before the next is over-ripe. Peanuts left too long in the ground are easily detached from the plant and consequently more difficult to harvest, while some varieties are liable to sprout.

Length of Crop.

The large nuts or creeper varieties require a longer time for growth to maturity than do the bunch or upright varieties, the time varying from fifteen to seventeen weeks for the bunch varieties and from seventeen to twenty weeks frequently for the creeper variety.

PLATE 36.
Peanuts at Warren, Central Queensland.

Method of Planting.

The land having been ploughed and brought to a fine tilth should be given a harrowing immediately prior to planting to destroy any weeds or their germinating seeds.

In general, drills are drawn out from 30 inches to 42 inches apart, the distance being influenced by the space required for the cultivating implement available.

Where no seed drill or fertilizer distributor is obtainable, the drills could be drawn out with a plough or a cultivator having a wide shovel attachment in the rear, the fertilizer dusted along this by hand, the cultivator then run along the drill with tines set close in front to mix the fertilizer with the soil, and the shovel attachment set at the back to reopen the drill for the reception of the seed to be dropped by hand; this drill should not be deeper than 4 inches from the levelled surface of the soil, and the seed should be covered to a depth of 2 to 3 inches,

according to the texture of the soil and its moisture content. In light soils where evaporation is great the deeper planting is preferable, but in stiffer soils the shallower covering should be adopted.

A light firming of the soil over the seed is desirable, and this is obtained in the seed drill by a wheel at the rear. When planted by hand the area may be covered with the harrow, or preferably by the cultivator, with tines straddling the drill and set so as to throw the soil inwards.

Most corn planters can be supplied with plates or other devices specially adapted for sowing either whole or shelled nuts.

The seed can either be planted whole or shelled. Whole nuts may be soaked in cold water twelve to twenty-four hours, drained, dried for an hour or two to assist handling, and then planted. This accelerates germination. Shelled seed should not be soaked.

Where shelled seed is used the shelling should be done by hand, though hand shellers carefully worked are sometimes used. All shelled seed in which the thin skin covering the seed is broken should not be sown, as this injury is liable to affect germination.

Breaking the pods in two answers the same purpose as shelling. Where the seed after planting may be subject to attack by vermin, the seed may be treated by sprinkling with a solution of equal parts of stockholm tar and kerosene. In this case, however, to protect the maturing crop it is advisable to destroy, by poisoning, the vermin beforehand.

Spacing.

The intervals between drills and the spacings between seeds in the drills vary somewhat, according to the richness of the soil and the variety planted.

The bunch or upright varieties take up much less room than the creeper or procumbent kinds, and the growth of both is correspondingly greater on the richer soil.

The spacing of the seed in the bunch varieties may be from 6 to 12 inches apart, and of the creeper varieties from 12 to 24 inches apart in the drill. An instance of success with close planting is noted from an experiment in which, in a light sandy loam, the bunch varieties were planted 3 inches apart in drills 30 inches wide. It is thought, however, in richer soils this crowding of the plants would be detrimental.

Time of Germination.

Germination usually occurs with shelled nuts in five days, but is subject to the amount of moisture and heat in the soil. The whole nuts take longer unless first soaked in water, as the moisture has to penetrate the shell to affect the berry or pea which contains the germ.

Cultivation.

Where close planting has been adopted the land may be harrowed with a light harrow shortly after the plants appear through the surface. Otherwise it will be better to use the cultivator between the rows and the hand hoe, where necessary, between the plants. The first one or two cultivations should be done with fine points, as in the strawberry cultivator or the 1¼-inch or narrowest shovel points supplied with the usual 5-tooth cultivator; after this the broader points can be used and

later the hilling attachments. In early cultivations the cultivator can work close to the roots, but not deeper than 2 inches; but later, after flowering, when the pegs enter the soil care should be taken that the plant is not disturbed.

In most soils it is desirable to draw a little of the soil in towards the plant to provide a bed of fine earth in which later the pods may form, and this can be done at each cultivation, finally leaving a flat bed in which the plants are growing with a water furrow between each drill. The height to which hilling may be practised depends largely on the soil. Usually, the heavier the soil the more necessity for hilling.

Soil should not be thrown on the centre of the plant, the object of hilling being to provide fine soil for the pegs to enter and mature evenly and for ease in harvesting. As a rule, in the creeping varieties the pegs easily reach the soil, but in certain cases a light roller run over the crop will facilitate this operation. In the bunch or erect growing varieties no rolling should be attempted, but a final higher hilling made if it is noticed the points have some distance to go to reach the soil.

Cultivation should be thorough, and an endeavour made to keep the soil in a loose and friable condition, especially around the plants.

Harvesting.

The time for harvesting is noted in the appearance of the foliage, which starts to yellow or lose colour, and by examination of the nuts. If the majority of the berries or peas are full grown and the inside of the shell has begun to colour and show darkened veins, the crop is mature and harvesting should not be delayed.

If the crop is harvested too early the proportion of "duds" is very great, while if deferred too long some of the nuts may germinate and others become detached from the plant when lifting, while the tops, having lost most of the leaves, will be of much less value for fodder. In some soils, notably the friable chocolate volcanic loams, the plants may be lifted by hand, when most of the nodule-bearing rootlets are left behind and only the root stock with the nuts is lifted. In other cases it is necessary to loosen the soil before lifting out. In small areas this is sometimes done with the digging fork inserted under the plant, which is lifted while the fork is worked underneath. In large areas a potato digger with an endless belt elevator from the shovel point is found very effective where the soil is dry enough to fall through the slats of the elevator and the crop is free from weeds.

An ordinary single-furrow mould-board plough with a 10 or 12 inch share is effective when the mould-board is removed, an improvement being found in the substitution therefor of some finger-bars which allow most of the soil to pass through and leave the vines and nuts uncovered.

A very satisfactory digger could, however, be made on the farm or by a local blacksmith by attaching to an ordinary wooden plough beam a knife edge to go under the plant and cut the roots just below the nuts; finger-bars at the rear of this knife edge would lift the plants and loosen the earth, thus facilitating the lifting by hand. The width of the knife edge should be sufficient between the attaching portions to the beam to allow of the whole plant passing through, and the depth should be regulated by the wheel or wheels in front. Perhaps a better idea might be given by taking the back off an ordinary earth scoop, together with

all the bottom excepting 6 inches in front, and substituting finger-bars slightly elevated to carry the plants and attaching the whole to a plough beam with handles. In a digger of this description, where one horse is used, the digging attachment would be to one side of the beam, while with two horses it would be in the centre, the operator straddling the row and the depth-regulating wheels being preferably two, one on each side of the line of plants.

It should always be remembered that the cutting of the roots as close to the pods as possible results in the greater quantiy of nitrogen being returned to the soil.

Harvesting should not begin until the dew is off and the tops are dry, and the operation should be regarded as a hay-making of the tops, and not more than can be handled should be lifted in any one day.

Plate 37.
Poles around which stacks of peanut vines are to be built.

Curing.

After the plants are lifted and the soil shaken from the nuts they are allowed to lie either spread on the ground or in small bunches until the leaves are wilted, but not curled or brittle. They are then bound in small sheaves or taken separately and stacked until cured. The time in which the plants are allowed to wilt varies according to the weather, and in some cases stacking may be necessary within an hour of lifting.

The usual method of curing peanuts where the quantity is large is to place them in small stacks around a pole. From twenty to thirty poles will be required for an acre.

These poles should be reasonably stout, from 2 to 3 inches of hard-wood in diameter at the bottom end, which should be sharpened. When erecting, holes are made in the soil with a crowbar, post-hole digger, or

earth auger, and the pole inserted or driven down with a mall to a depth that will ensure their not being blown over with the weight of the stack upon them. Crosspieces about 3 feet in length are now nailed across the post at right angles, one immediately above the other, 9 to 10 inches above the level of the ground; 3 by 1-inch hardwood battens answer the purpose admirably. According to the crop, six or seven rows are taken on each side of the poles, and the plants, when wilted, forked into one row on either side of the pole. When stacking, a few vines are placed across the crosspieces, which keep them off the ground, to form the foundation. The vines are then stacked by hand with the nuts next to the pole and tops outward, pressing down each layer and building evenly around the pole. From time to time a bunch should be divided and hung around the pole to bind the mass and to assist in keeping the centre high.

This latter is important in that it allows any rain falling to run off. When the stack is approaching 3 feet high the vines should be drawn closer round the top and finished off with a cap of grass as a thatch to run rain off. It is important that free circulation of air should obtain through the stack in order to facilitate curing. The building of thick or high stacks or pressing them too tight will tend to cause heating, with consequent damage to both fodder and nuts.

After about two weeks in the stack the peanuts may be stored in the barn, but the nuts should not be picked from the vines until preferably six weeks from the date of harvesting, as if picked too soon they are liable to shrivel, and there is danger of fermenting or moulding after picking.

Plate 38.
Showing method used in building stacks round the poles. Completed stacks in background.

Picking.

The usual practice formerly was to pick the nuts from the cured plants by hand—a tedious process, the cost of which, if the ruling rate of wages were paid, would be prohibitive, since 60 lb. is considered a fair day's work. This practice of hand picking has been followed for ages, and is still the usual method adopted in countries such as India, China, Japan, &c., where labour is plentiful and cheap. In certain cases, too, the nuts are washed by agitation in frequently changed water and dried in the sun to obtain a clean inviting article for edible purposes. This is necessarily a costly undertaking, and would need a much higher price for washed nuts to compensate.

Other methods adopted in Queensland with a lessening of expense have been, in the case of the bunch nuts, to hold the stems in the hand and thresh the nuts off by beating across tightly-drawn wires or the edge of a board placed midway across a box or other receptacle to hold the nuts, and with both bunch and creeper to rub the whole plant over a wire-netting drawn tight until the nuts fall through. Subsequent winnowings remove trash and light pods, and it is stated thoroughly drying the resultant nuts in the sun will cause the stems or tails to break off in the bags, resulting in a clean sample when it reaches the market.

Plate 39.—Peanut Picker at Work.

In recent years, however, labour and time saving machinery has been evolved which does very satisfactory work in picking, stemming, cleaning, grading, and bagging for market, without breaking or damaging any appreciable quantity of the pods.

Two types of pickers are on the market—one working on the principle of a cylinder grain-thresher and another in which the plants are drawn between spring points over a wire mesh in such a manner that the nuts are pulled off and fall through on to a conveyor, which carries them

through a winnowing process to a stemming apparatus, after which they go through a further winnowing and a cleaning and grading process.

The cost of machines of this description is too great for the individual in most cases, and it would be advantageous, where any considerable collective area was under crop, for farmers to co-operate in a purchase, when the machine, which is on wheels, could be transported from farm to farm.

Contract picking of peanuts should prove economical and effective as the picking crew, working day after day, naturally become expert; so that a greater average quantity is handled daily with less damage than when novices or hands out of practice are engaged.

When a power-driven picker is in use, it is advantageous to place it in a central position in the field where the poles with the stacked peanuts can be transported bodily to the machine, resulting in less handling. With suitable uprights with a cross bar attached to the dray a lever with a grip attached to the top of the pole and passed over the cross bar would use it as a fulcrum, when the long end of the lever being lowered to the shaft would lift the pole entirely clear of the ground, allowing of its quick and easy transport to the picker.

The stems or vines of the plant, after the nuts are detached by the picker, can be stacked, baled, or chaffed and used for forage purposes, while the "dud" nuts (small or immature) can be fed to stock.

Marketing.

Where more than one variety is grown it is important when marketing that each should be kept distinct. Peanuts are usually bagged whole for sale; in this condition care should be exercised to see that the shells are quite dry, as clean as possible, and free from immature nuts and foreign matter.

In localities where freights are high, it is sometimes more remunerative to grow suitable varieties for shelling and to market in that condition.

Special machinery is available to shell peanuts with a minimum of damage to the berries. Bruising of the product at shelling or during transport is injurious as decomposition is liable to set in and rancidity occur. Shelled kernels should also be absolutely dry before packing for the same reason.

Peanut Pool.

Legislation provides for the marketing, within Queensland, of all peanuts through the Peanut Pool Board, the headquarters of which is at Kingaroy.

Full information in connection therewith can be obtained by application to the manager or secretary at that centre.

The Board is generally a source of seed supply.

Pests.

Insect pests are of infrequent occurrence, so far the only attack noticed being occasional instances of mealy bugs on odd roots.

Vermin are very partial to the nuts, as are many birds outside those domesticated.

Disease.

The peanut is seldom subject to disease when grown under suitable conditions of climate, soil, and drainage. That most commonly noted is a form of leafspot (*Cercospora* sp.) which appears as brownish spots on the leaves, and is most frequent in crops maturing towards winter, and especially on sour or poorly drained land.

Others that are occasionally seen are possibly *Sclerotium rolfsii*, and a species of *Rhizoctonia*, which attacks the plant at the collar or that part of the stem at the point of its emergence from the soil. This is denoted by a cobwebby appearance due to the spread of mycelial threads, together with minute round white or brown bodies the size of mustard seeds which are the spore cases of the fungus. The effect on the plant is to stunt the growth where it is not killed outright. The affection, however, is seldom sufficiently serious to materially affect yields.

Yield.

The yield of the peanut crop will, of course, depend on the fertility of the soil, amount of rainfall, and cultural attention bestowed.

While it will bear a satisfactory crop under a small rainfall, showing to an extent that it is drought-resisting, it is not injured by excessive rains provided the soil is well drained. An instance of this was observed at Banyan in 1921, where a perfect sample of the Red Cross variety was seen which had experienced a fall of 120 inches of rain in the growing period.

Crops on a small scale have been estimated to produce 3 tons to the acre, and in the North field crops averaging 1 ton and over are not uncommon; but as a general rule, in satisfactory soils and under ordinary conditions with proper cultivation, 15 cwt. per acre might be expected as a fair average yield.

On many of the poor sandy soils which are recommended for bright tobacco, however, much lower yields, even with fertilizers, can be expected until the humus content is greatly increased by the ploughing under of suitable growing crops or otherwise.

Varieties.

As with most cultivated crops the number of varieties is not inconsiderable; their nomenclature, however, is somewhat varied according to the country in which they are grown. A variety in one country is often identical with that listed under a different name in another.

Varieties fall naturally into two groups—viz., the bunch or upright growers which produce the nuts around the base of the plant, and the creeping or procumbent kinds which produce the nuts along the stems for a considerable distance from the base. These again are divided into kinds which produce large and small nuts respectively.

The creeper varieties usually return a greater yield per acre, but the increased expense in harvesting is calculated to more than offset the somewhat lower average yield of those of upright growth.

The following varieties are most commonly grown:—

Red Spanish also Red Cross.—A strong upright grower with abundant foliage; small, well filled pods clustered about the base of the

plant; yields well and probably gives a lower proportion of shell to peas than other kinds. Peas are bright red in colour and of medium size with a high oil content. Favoured for shelling.

White Spanish.—A small podded variety with upright stems and heavy foliage; pods are thin, usually well filled and are clustered about the base of the plant. Peas are pale brown in colour and rich in oil. Perhaps the most early-maturing variety grown. Suitable for shelling.

Improved Spanish.—This variety has probably been developed by careful selection from the White Spanish which it resembles, except that the stems are stronger and not so upright. The chief difference, however, lies in the pods, which are much larger. Suitable for shelling.

Virginia Bunch.—A large-podded variety; stems upright, not as high as White Spanish and with less foliage. Pods are clustered about the base of the plant and contain usually two and sometimes three light-brown peas of good size. Pods are usually bright and clean, and the variety yields well. Recommended for sale as whole nuts.

PLATE 40.—VIRGINIA BUNCH.

Valencia Bunch.—A small-podded variety with heavy foliage and upright stems. Pods are usually long, containing three or four small peas, sometimes more; peas are dull red in colour. The variety yields well, but the pods do not adhere so well in digging as with the previous-named varieties. Only suitable for shelling, as the pods are apt to burst during the roasting process.

The foregoing are all of bunch and upright growth, the Virginia Bunch being grown most largely for the whole-nut trade and the Red Spanish for sale as shelled for manufacture.

Chinese.—A large-podded variety of strong growth with creeping or prostrate stems and heavy foliage; pods scattered along the procumbent stems do not adhere too well in digging. The pods are much the same size as those of the Virginia Bunch as are the peas within. The variety is probably the same as that called Virginia Runner. The Chinese Runner formerly was largely imported from China, and was chiefly grown in the Cooktown district.

Large Japanese.—A creeping or procumbent variety of perhaps less vigorous growth than the Chinese, but carrying a slightly larger pod. It was considered superior to Chinese in the Cooktown district. Both this and the Chinese are suited for sale as whole nuts.

Mammoth, Jumbo, or Giant.—A creeping variety that yields probably the largest pod of all varieties. The shell, however, is very thick and the proportion of peas to pod lower than in other varieties. The pea is extra large, and on this account is sometimes favoured for particular confections. It is not considered suitable for cropping in this State in competition with more popular varieties.

Rotation.

In order to secure the most profitable return peanuts should be grown in a sequence or rotation with other crops preferably once in every three or four years.

Though the crop, in common with most other legumes, has the power of collecting the free nitrogen from the air and storing it up in small nodules on the roots, its value in this direction is not so great as cowpeas, velvet beans, and other legumes of similar growth, since in harvesting much of the root system of the peanut with adherent nodules is removed from the soil. The amount of nitrogen, however, added to the soil by the peanut crop is considerable and well illustrated in the improved growth of following crops, such as maize or potatoes.

In all crop sequences it is advisable at least once in three or four years to plough under a growing crop to maintain or build up the humus and decaying organic matter in the soil.

Choice of such a crop would be influenced by the volume of growth likely to be made in a short period and the rapidity of its decay or conversion to humus when ploughed under.

Crops such as cowpeas and velvet beans are popular through the amount of nitrogen they add to the soil; but sorghums, teosinte, millets, and especially Sudan grass are generally allowed to provide a greater amount of organic matter during a similar period of growth.

On loamy soils where potatoes, sweet potatoes, and maize would be grown preference would be given to the legume; but on sandy soils, particularly those suited to bright tobacco production in which the humus supply is usually low, preference should be given to the heavier-yielding non-legume.

A suitable sequence of crops is suggested:—

(*a*) For loaming soils—

First year—Legume, to be ploughed under.

Second year—Potatoes, sweet potatoes, maize.

Third year—Peanuts, cotton, broom millet.

(*b*) For sandy soils—

First year—Non-legume, to be ploughed under.

Second year—Hay or grain crop.

Third year—Peanuts, cotton, broom millet, tobacco.

Uses.

The peanut is a most valuable economic crop and capable of many diversified uses, the chief of which may be summarised:—

The whole plant as a stock food either to be fed off or harvested and stored for use as required;

The plant, exclusive of the nuts, cured as hay, in which it is close to lucerne in food value and fed to stock;

The nuts for edible purposes either as whole nuts or shelled for use in confectionery;

The nuts for oil;

The residue after extracting the oil, in some cases for edible purposes, but mainly for stock food or as manure.

As a rotative crop, also in sequence with tobacco, maize, and other crops, the peanut is commended.

Hay.

Whether the whole crop, especially the bunch or upright growing varieties, is harvested and stored as hay with or without the adhering pods the product forms a valuable stock food. The greatest economy, of course, lies in marketing the nuts and using the balance as hay, but where through a high cost of freight this is not practicable the added food value of the nuts is considerable.

As noted previously in this article, the harvesting of the crop should be regarded as a haymaking of the tops. As with lucerne the loss of the leaves in harvest results in a considerable reduction in fodder value as well as in weight. Care consequently should be exercised to prevent undue loss in this direction.

There is probably no better or more economical system of harvesting than the pole stacking previously described, the advantages of which should be obvious. The stack round the poll allows a free circulation of air below and through the curing mass: the curing is gradual with a full retention of the leaves, which retain their green colour, except round the edges of the stack where exposed to dew and direct sunshine.

There is less handling, as, when cured, the poles, each with its burden, can be lifted and transported to the picker, after which the hay can be stacked or baled ready for home feeding or sale.

The following analyses* comparing the fodder values of peanuts and lucerne are informative:—

	Total Dry Matter.	Digestible Nutrients in 100 Lb.				Nutritive Ratio.
		Crude Protein.	Carbo-hydrates.	Fat.	Total.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
Lucerne	91·4	10·5	39·0	0·9	51·6	1 : 3·9
Peanut vine	78·5	6·6	37·0	3·0	50·4	1 : 6·6
Peanut vine with nuts ..	92·2	9·6	39·6	8·3	67·9	1 : 6·1

In palatability, probably peanut hay is ahead of lucerne, as stock greedily eat the hard sun-dried stems, no matter how long exposed.

In feeding the hay or the whole cured plant to horses and cattle, the receptacle should allow of any soil adhering to the roots falling through; the danger in feeding mouldy peanut hay is the same as with mouldy hay of any other kind.

Feeding-off.

On farms where pigs are raised it is usual to turn the animals into the field to harvest such nuts as may be left on removal of the crop. This is especially desirable when creeping or running varieties are grown.

Occasionally also, where the bunch varieties are grown, the tops are mown, cured into hay, and removed prior to turning the pigs in to harvest the remainder. This would appear preferable to feeding off the whole crop as, though the animals would consume a certain amount of the vines, a greater quantity would be soiled and destroyed.

There is a prejudice against pigs fattened on peanuts, since the pork is soft and shrinks more in curing processes than when maize or other concentrates are fed; the lard, too, from peanut-fattened pigs is undesirably soft and oily.

These defects, it may be noted, appear in pigs fattened exclusively on peanuts, but it may be expected that when young animals are grown thereon and topped off with other foods known to produce firm flesh the difficulty would be obviated.

Manufactures.

In addition to the treatment of the shelled and unshelled peas for human consumption, there are numerous products as oils, butters, flours, meals, breakfast foods, relishes, sauces, confectionery, &c., manufactured wholly or partly therefrom.

Oil.

The chief value of the peanut is as a source of oil known to the trade as China oil.

The shelled peas of the large nuts, such as Virginia Bunch and Chinese Runner, contain an average of about 43 per cent., while the smaller nuts of the Spanish Bunch varieties, particularly the Red Spanish, frequently yield 52 per cent. of oil.

* Henry and Morrison in "Feeds and Feeding."

Amongst the uses of the oil are:—Finest oil as salad oil and for use in medicine, the arts, and as a lubricant for high-speed journals in delicate machinery, &c.; first quality grade for cooking and in the manufacture of margarine; also as a lubricant and harness dressing, &c.; lowest quality grades for soap-making and other industrial purposes.

The extraction of the oil is a simple process and entails less procedure and machinery than other oil-yielders. The bulk of the oil is obtained by simple pressure, and the balance recoverable on heating and again subjecting to pressure.

Oilcake or Meal.

Where particular attention is paid to the skinning and degerming of the peas before the oil is expressed, the resultant cake or meal is used in the preparation of human foods; otherwise, the cake is used for stock food and as manure.

Average analyses of peanut oil cake show, according to Henry and Morrison:—

	Total Dry Matter in 100 Lb.	Digestible Nutrients in 100 Lb.				Nutritive Ratio.
		Crude Protein.	Carbo-hydrates.	Fat.	Total.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
From whole nuts	94·4	20·2	16·0	10·0	58·7	1 : 1·9
From shelled nuts	89·3	42·8	20·4	7·2	79·4	1 : 0·9

The feed value of these products is at once apparent; and, viewing the richness in protein as evidenced in the nutritive ratio, it becomes most valuable as a concentrate for addition to stock foods in making a balanced ration.

FIELD CROPS.

Speaking recently on crop prospects the Director of Agriculture (Mr. A. E. Gibson) remarked that the lucerne crop had in many instances been spoilt in harvesting by reason of excessive rains, and, no doubt, considerable quantities of hay had been more or less damaged. It was reasonable to believe, however, that from now onwards conditions would be more suitable for both the production and conservation of lucerne in the form of hay, provided the country experienced normal conditions usually associated with this period of the year.

Mr. Gibson advised those farmers who contemplated increasing their lucerne areas to set about the initial preparation as soon as opportunity offered, with the fixed purpose, as far as possible, of eradicating every description of weed. It was imperative that the soil prepared for lucerne should be reduced to as fine a tilth as possible in order to stimulate rapid growth, and at the same time bring about rapid germination. Sowing by means of the drill in this crop was to be recommended, and better results would be achieved if the first half of the seed were sown at right angles to the second half. In this way a better planting was brought about, and the quantity of lucerne seed used could be reduced by at least 25 per cent., compared with the more common method of sowing.

Those who intended planting winter cereals were advised that fallowing operations should now be well under way, particularly in the case of the wheat areas. Any action that could be taken, which was calculated to bring about rapid germination of volunteer crops, such as oats and barley, should be given attention to, as considerable trouble already had been experienced in the wheat-growing areas from this source. The loss in quality of the grain, caused by foreign growth, was considerable.

The Housing of Poultry.

By P. RUMBALL, Poultry Expert.

A SURVEY of many farms indicates that one of the principal causes of impaired health and high mortality is due to inadequate housing. It is not the case only that the housing accommodation is too small, but that it is of the wrong design, and does not lend itself to the easy maintenance of those sanitary conditions necessary to health and vigour. Elaborate and costly houses are not necessary, but they should be of sufficient size for easy access, and the floors should be as impervious as possible, such as concrete, so as to permit of thorough cleaning at definite periods. Buildings are generally erected for a definite number of birds, but it is found that, as the flock increases, the tendency is to use these buildings for greater numbers than for which they were originally designed. This evil is not only noticed with reference to the accommodation of adult stock—where the least harm is caused—but it is more pronounced in the accommodation used for the rearing of young chickens and growing stock.

The success of a poultry raiser is dependent firstly upon the number of chickens that are reared to maturity, and, as overcrowding is one of the principal causes of mortality amongst chickens, the consequence of insufficient accommodation becomes more serious as a poultryman extends his business. It has also to be borne in mind that the loss through overcrowding does not end in the death of chickens. Others may survive improper treatment, but their health and vigour are so impaired that their potential egg yield is greatly decreased.

Systems of Housing.

There are three practices commonly adopted, viz.:—

(1) Intensive, where the birds are kept entirely under cover;

(2) Free range, where a house is erected to provide sleeping accommodation, and unrestricted liberty permitted; and

(3) House and yard, where a house is provided for sleeping quarters, and liberty is restricted by the erection of a run.

Under the intensive system, the birds are kept entirely under cover, and are thereby afforded the maximum protection from climatic conditions, ensuring greater stability in production. The health and condition of the birds are readily observed by the farmer. Further, it is possible to thoroughly free the house from excreta at regular intervals.

Under the free range conditions, some contamination from excreta of the stock naturally takes place, but, owing to the unrestricted range and the feeding on the soil by plant life, soil contamination does not become serious. The birds are, however, exposed to climatic variations, and the egg yield is not as stable as under the intensive system. There is, however, the compensation in the reduced cost of feeding, as birds obtain a good deal of their natural food supply by foraging.

The yard and house system has the disadvantages and none of the advantages of both the intensive and free range systems. The addition of the yard adds to the cost of accommodation. The birds are exposed to climatic conditions as much as they are under the free range system.

Egg production is not stable, nor are the birds in a position to gather any of their own food requirements. The most serious disadvantage, however, of this system is soil contamination. A good many of the highly contagious diseases of poultry, and internal parasites, are transmitted from bird to bird through the excreta. Many organisms of the common diseases of the fowl will lie dormant in the soil ready to cause infection on the first favourable opportunity. Although the excreta may be scraped regularly from the surface of the poultry yard, many of the minute organisms and worm eggs are below the surface, and it is only necessary for favourable conditions to arise before infection takes place.

When the house and yard system is adopted, two yards should be erected for each house. This enables one yard to be spelled, planted with some crop suitable for green feed, and the soil thus sweetened.

For the specialist poultry keeper, where large numbers of laying stock are to be kept, the intensive system of housing is most suitable. For the farmer who raises poultry as an adjunct to other rural pursuits, the free range system offers many advantages.

Care of Growing Stock.

In the housing of growing stock the pens are only occupied throughout six months of the year, and as egg production does not enter into consideration, the exposure to climatic conditions is not so material. Likewise, soil contamination is not pronounced. To obtain the maximum development, exercise must be provided. The free range system answers admirably for the purpose of the development of growing stock, but as several hundred pullets of different ages have to be reared, it is necessary to erect netting fences for the separation of the various lots. These runs should be made as large as the land will permit, allowing not less than 6 square yards per bird, and the number in any one pen should not exceed one hundred.

Brooding of Chickens.

There are numerous systems of brooding chickens. The system to be adopted depends largely upon the number to be handled, the personal inclinations of the farmer, and the capital to be expended. The subject of brooding is too extensive for full reference in this article.

Intensive Housing System.

Under this system of housing, as previously mentioned, the birds are kept entirely under cover in fairly large sheds, and in relatively large numbers. This being so, strict attention has to be paid to the physical condition of the bird, and to the question of feeding. As the bird only has a very restricted space, 4 square feet per bird being about the correct area, exercise has to be promoted to ensure the birds being kept in good condition. This is done by having scratching material or litter, such as grass, straw, leaves, or chips strewn over the floor, to the depth of 4 to 6 inches, and all the grain portion of the ration being fed in it. This naturally promotes a good deal of scratching on the part of the bird in search of grains that have become covered, and it should be patent to all poultry raisers that the feeding of the evening grain should not be left until the day is drawing to a close. Many farmers are in the habit of allowing a good deal of range to their birds, with the consequence that they gather a fair amount of natural food, and naturally

Plate 41.—On a Queensland Poultry Farm. The Intensive System Adopted Wholly for Laying Stock.

Housing under the intensive system allows 3½ to 4 square feet of floor space for each bird; under the free-range system 2 square feet are sufficient.

do not consume as much as birds kept entirely under cover. If at any time poultry breeders keeping birds under such conditions think it desirable, on account of the damage done by their poultry to crops, haystacks, &c., to change over to the intensive system, the question of feeding assumes a most important point; in fact, any person keeping poultry under these conditions must give the question of feeding the utmost consideration, as it is impossible for the birds to procure anything but what they are supplied with. The overlooking of this point by many poultry farmers has caused this system of housing to be condemned.

This system of housing poultry enables a greater number of birds to be kept on a given area than any other. It permits of birds being handled in large units, and therefore not only reduces the natural labour but goes a long way in reducing the cost of production, which is a big feature, especially in times of high-priced foods. It is also much easier to detect sick and unproductive birds in an area of, say, 400 square feet than is the case when large runs are used, and therefore the early disposal of these, a practice highly desirable, is facilitated. With this system also there is generally greater attention given to the questions of the construction of the houses and the numbers housed in a shed of certain dimensions. Both these questions play a very important part in the question of disease, and the development of stock. It is not uncommon to notice a house built to house at night fifty laying hens having sixty-five birds in it. To do this, possibly the perches have been placed closer together, and when it is suggested to the breeder that he is overcrowding, he states that they only sleep in the shed and he lets them out on free range during the day. Although it must be admitted that stock on free range will possibly put up with much severer conditions than those kept in pens, it is maintained that it does not matter how good the conditions are during the day, they will not overcome the ill-effects of overcrowding during the night. With the intensive system of housing, overcrowding is not noticed to the same extent; the breeder knows how many birds the shed was built for, and there is no point that can be raised in favour of going beyond this number.

Types of Intensive Laying Sheds.

There are several types of laying sheds, the shape of the roof being the principal point, but as the majority of poultry raisers have to do the erection of their own sheds, the lean-to type will prove most acceptable. The illustration shows the cross section of a shed, 20 feet deep, and of indefinite length. This shed can be built in sections of 20 feet, and provision made for additions as required, each section holding 100 laying hens.

The cross section shows a veranda, which commences just under the rafters in front. This veranda serves to prevent a good deal of rain beating into the house from the front, and by not going right to the top of the roof allows a free circulation of air. If it is desired the roof could be extended by 3 feet and the veranda not used, but in that case the height of the shed in front could be a little bit less. Ventilation is also provided for at the back, the iron going from the floor level to the bottom of the 6-inch rafter. This allows a 6-inch space right along the back of the shed between the battens which carry the iron at the back and the roof. This space is protected to some extent from the driving influence

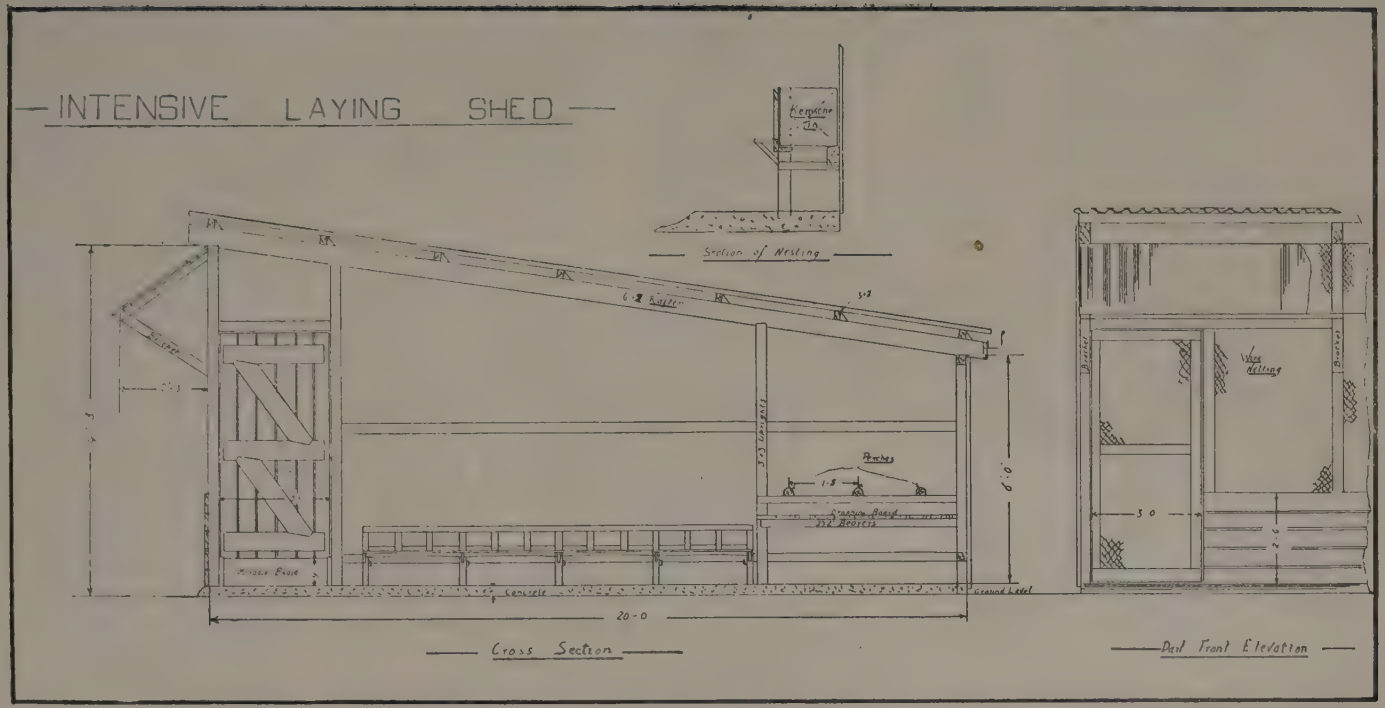


PLATE 42.—SHOWING END SECTION AND PART FRONT ELEVATION OF INTENSIVE LAYING SHED.

End section, with the exception of door and battens to carry the iron, should be erected every 10 feet in a shed of these dimensions.

of the wind by guttering being placed on the rafters, which extend beyond the back wall, but further protection for the birds from cats, &c., should be made by netting this space.

Materials.—The shed should be built with good, sound hardwood posts, although where desired solid, sapped bush timber could be used for uprights, but the average builder would find sawn timber easier to handle. All other frame work should be sawn timber, that coming in contact with the ground hardwoods, and the balance pine. The dimensions of the timber are shown in the cross section, and as the building is of goodly dimensions, it would not be advisable, on the plea of economy, to use lighter material. The walls and roof should be of iron, and also the wind break in front, although timber, if cheaper, could be used.

The Site.

Site of House.—In commencing to erect a building upon the intensive system, it being a large building and of a permanent nature, the site chosen must receive due consideration, and, as many poultry raisers start in a small way, provision should be made for extensions.

In addition to the foregoing, although it is recommended to concrete the floor, the position chosen should be well drained, and, if the building is to be erected on relatively flat country, the floor should be raised several inches above the surrounding country, and well rammed to provide a solid foundation.

Aspect.—The house should face north or north-east. A northerly aspect permits of the maximum penetration of the sun's rays into the house during the winter, when it is desirable, and the minimum during summer; also a good deal of our continuous rains come from a south-easterly direction.

The Layout.

General Fittings.—In the cross section a door constructed of timber is shown, while the front elevation shows another of netting. Although this shed is built for the purpose of keeping the birds entirely under cover, it frequently is desirable to let the birds out into small runs during cleaning operations, or it may be that, in a long section, it is desirable to go into a pen direct. This is only possible when front doors are provided. The door in the end section permits a person feeding, &c., going from pen to pen direct, and, for the small cost in labour and material, both doors should be provided when the building is first constructed.

The perches, three in number, are placed along the back of the shed extending the full length. Under the perches is a dropping board. The advisability of this or otherwise is left to the individual breeder. If it is not to be cleaned daily, it should not be provided, but for the breeder who uses it there is a ready market for pure poultry manure, while, at the same time, he keeps his litter clean for a longer period. Another system by which the droppings may be kept from mixing with the scratching material is by placing timber, say, 6 inches in front of the front perch the full length of the building. This timber would need to be at least 18 inches high, and it may be as well to cover the whole area with netting to prevent the birds from getting in among the droppings. This pit, however, would need to be cleared out fairly frequently to prevent offensive odours, as there would be nothing to absorb any moisture. With the

dropping board the birds have the full floor to scratch over, but a sharp lookout must be kept for red mite, as it provides additional harbour for them.

The nests are shown supported on a framework on the side of the building. These are kerosene tins on their sides. Two-thirds of each side is cut out. This provides a top which assists in keeping clean nests, and by both sides being cut the excessive heat is reduced. These should be placed at the coolest end of the building. Even although nests are provided many birds will persist in laying under them or in some old corner. If this is the case, the nests could be placed on the ground, as it is as well to induce the birds to make use of them to keep the eggs as clean as possible. Drinking and feeding receptacles are left to the breeder's own device. Some may be able to make use of some form of automatic water system, others may have to depend upon the kerosene tins. Some breeders may use dry mash hoppers, while others feed a wet mash. The principal feature is to provide ample water and sufficient feeding space for your stock. It is better to overdo both these features than to economise in this direction.

FAT-LAMB PRODUCTION—LESSONS FROM NEW ZEALAND.

Pasture improvement as a means to adequate feeding was an essential factor in profitable fat-lamb production, pointed out the Agrostologist of the New South Wales Department of Agriculture in a recent wireless address. In New Zealand, said the speaker, he had been impressed by the provision made for the supply of succulent pasturage on the numerous farms where the production of prime sucker lambs was aimed at.

In that country good sheep management, feeding, and breeding had gone hand in hand. The New Zealand lamb raiser had realised many years ago that in order to produce a quicker-maturing, prime quality lamb, grading up of the pastures was absolutely essential, as early-maturing stock, whether beef or mutton producers, required an abundance of palatable, nutritious feed.

The main reasons why New Zealand could produce and maintain a supply of sucker lambs suitable for the export trade were:—

(1) The excellent pastures available, also climatic conditions which were conducive to the optimum growth of nutritious English grasses and clovers.

(2) The utilisation only of sheep of the highest quality in the production of export lambs.

As New Zealand practically depended on grass-land farming to provide all the feed required for sheep and cattle, it was only to be expected that every farmer had the grass-land "sense" particularly well developed. In New Zealand 16,000,000 acres of land had been planted with seed of succulent pasture plants such as perennial rye, cocksfoot, perennial red and white clovers, and 300,000 tons of artificial fertilizers were applied to grass-land areas annually. The New Zealand farmer appreciated the value of his pastures, and all his efforts were centred on maintaining a high state of soil fertility.

When the soil fertility of any area decreased, it was inevitable that the plants associated with a high standard of fertility would diminish in quantity and ultimately disappear from the pasture, poorer quality pasturage and weeds taking their place. Good quality stock and particularly fat lambs and baby beef could not be raised on poor quality grass-land areas.

Agricultural Notes.

By H. S. HUNTER, Agricultural Branch.

SEASONAL PROSPECTS.

THE advent of hot weather after the wet conditions of December has stimulated the growth of vegetation and facilitated completion of the wheat harvest. It has been favourable also for haymaking, and full advantage has been taken of it in the principal lucerne-growing areas, where the crops had made excellent growth. The markets have been heavily supplied with lucerne chaff and lucerne hay, both of which lines have been selling freely at low values. Many of the offerings in the earlier part of the month were of indifferent quality, due to inclement weather at the time they were cured.

Potatoes also have been arriving in large quantities, with, as a result, unattractive prices to the grower, but in many instances the return was unnecessarily low owing to faulty grading and bagging. Uniform grading of most lines of farm produce, particularly potatoes, is essential if the consignment is to be disposed of to the best advantage.

Wheat.

From reports to hand at the time of writing, the deliveries to the Pool are estimated to represent about half of the current season's crop. Late deliveries will be unavoidable this year owing to the fact that weather conditions have interfered, not only with harvesting operations, but also with the transporting of the grain to the receiving depots.

The same set of conditions has delayed the initial working of the fallows of the proposed wheat areas for the 1934-35 season. Early and thorough preparation of the land is an important factor in successful wheatgrowing under Queensland conditions. It places the land in receptive condition for the trapping of moisture from the late summer rains, and facilitates the early germination of any grain and weed seeds which may be present in the soil. The present season has favoured volunteer growths, the early eradication of which is desirable.

Canary Seed.

The harvesting of this crop also has been delayed by weather conditions. Clean land is more essential, perhaps, for canary seed than for the other cereals.

One of the causes of excessive expenditure in connection with the Canary Seed Board's operations is the necessity for cleaning the seed to fit it as a merchantable product which would conform to pure seed regulations existing in this and other States of the Commonwealth. This has necessitated, in some instances, the cleaning of consignments three and four times. The cost of the first cleaning is a pool charge, but all subsequent cleanings are individual charges against the consignment concerned. It therefore is in the interests of canary seed growers to produce grain free from foreign seeds. The crop should be grown on land which is as far as possible free from volunteer growths of winter cereals and weeds.

Two weeds which give a considerable amount of trouble are fat hen (*Chenapodium*) and convolvulus (*Polygonum vulgare*). Incidentally, consignments have been received containing *Datura* or thorn apple, sometimes known as oil plant, and such are held up for cleaning before any

advance payment is made. The *Datura* plant is easily distinguishable and, therefore, roguing from the crop during harvesting operations is facilitated.

Cotton.

Some abandonment of crops has been caused by more or less excessive wet conditions, especially in the Central district. It is believed, however, that at least 70,000 acres are under cotton with prospects of producing profitable yields.

Reports from all centres indicate that although the season has been fairly wet to date, no excessively rank development of the plant has occurred, the majority of the crops having plants of a nice type, and carrying a good crop of flower buds and young bolls, with the most advanced crops bearing several well-developed bolls.

Good rains will be required in the near future in order to develop the crop which is now setting, and given these it is anticipated that many heavy yields will be obtained in all districts.

Insect attacks have been very light so far, the main trouble being mostly terminal loss caused in the earliest planted crops by the rough boll worm and to some extent by the tip-boring worm.

The season has demonstrated the value of cultivating as soon as the rows of young seedlings are discerned. Where this has been done even the growers with large acreages have well-cultivated fields, but where it has been neglected the continuous showery conditions produced such a rank growth of pig weed and summer grass that the later cultivations could be made only with great difficulty, and in extreme cases a portion of the individual acreage has had to be abandoned.

Dairying.

The output of dairy products is exceptionally heavy in all districts, and in some instances the factories are experiencing difficulty in coping with the quantities of cream coming forward. Australian butter reached its lowest level in London last month, when it was quoted at 63s. per cwt. Unfortunately, the local price has been influenced accordingly. The lot of the dairyman should be improved to some extent when the stabilising legislation, recently passed by the Commonwealth and the States, becomes operative.

Another step in this direction was taken in Sydney last month, when an interstate conference of dairy industry representatives agreed on proposals for the regulations which are to be set up under the Commonwealth Act.

Fruit.

The deciduous fruit season has been marked by low values owing to the size of the crop and the high proportion of fruit affected by excessively wet weather. An excellent yield of apples is in prospect, but marketing difficulties are anticipated unless the local market can be relieved by increased export. Last season witnessed an increase in production of approximately 100,000 cases, and a further progressive increase is expected this year.

Banana and pineapple plantations benefited by the wet conditions, but weeds have caused considerable trouble, necessitating the use of sprays. Permits have been issued covering the planting of over 4,000,000 banana suckers, the heaviest plantings having taken place in the Currumbin area. Growers in all areas, including the North Coast, have been warned of the necessity of vigilance for the early detection of bunchy top infestation.

Maize Varieties for the Lockyer Valley.

A report of the trials conducted at the Queensland Agricultural High School and College, Gatton, during the seasons 1925-26 to 1932-33 inclusive, by J. R. A. McMillan, M.Sc. (Cornell), Senior Plant Geneticist, Division of Plant Industry, C.S.I.R., and W. W. Bryan, B.Sc. Agr. (Queensland), Instructor in Plant Breeding, Q.A.H.S. and C.

IN view of the importance of maize-growing in the Lockyer Valley of Queensland, it was thought desirable to conduct experiments to determine the most suitable variety or varieties for the district. To this end work was commenced at the Queensland Agricultural High School and College in the year 1925-26, and is still in progress. It was felt, however, that as some definite results have been obtained, they should be made available to growers.

The maize is grown under conditions approaching, as far as possible, those which would be adopted by progressive farmers in the district, although certain modifications had of necessity to be adopted since the work is experimental. In the Lockyer Valley it is usual to grow maize on the same land for two or three years in succession, hence it was decided to conduct the trials on land in its second season under maize.

The site chosen is changed annually in accordance with the College farm rotation, but the soils throughout are fairly uniform, being heavy black soils with calcareous nodules forming a sub-surface layer—a Tshernosemic phase. Fertilizers are not used since previous experiments have not shown any beneficial response to them.

The average annual rainfall for the district is between 27 and 28 inches, but the majority of this falls during the maize-growing season. The actual amounts for the growing season are given with the results each year (see below).

Varieties Used and Sources of Seed.

It was decided to include in the trial some of the most promising varieties used in Queensland and New South Wales which would be likely to succeed under the conditions. Seed of these varieties was obtained originally from the State Departments of Agriculture. In order to ensure uniformity of strain within the variety, subsequent seed was and is being obtained annually from a State Department of Agriculture when possible. Otherwise it is produced at the College under isolated conditions in order to prevent cross breeding. The following varieties are obtained regularly, or were obtained until discarded, from the sources stated:—Golden Beauty, Funk's Yellow Dent, Improved Yellow Dent, and Red Hogan from the Department of Agriculture and Stock, Queensland; Fitzroy, Giant White, Golden Beauty, Golden Nugget, Golden Superb, Hickory King, Kennedy, Leaming, Manning Silvermine, and Yellow Hogan from the Department of Agriculture, New South Wales. Red Nib is obtained annually from the same seedsman. For comparison with the abovementioned varieties, seed is selected

from College-grown crops of Fitzroy, Improved Yellow Dent, and Red Hogan. Thus, in all, seventeen varieties have been tested, some of which have been discarded when proved unsuitable.

Methods.

The land is prepared in the usual manner sometime before it is required. At planting time drills 4 to 5 inches deep and 4 feet 6 inches apart are opened with a specially-made double mould-board attached to the tines of a cultivator. A wire, with tapes tied at intervals of 3 feet to act as markers, is stretched along the row, and five seeds are sown at each marker. The wire is removed and the drill closed by means of a single-row scuffler or harrows, the seeds being covered to a depth of about 2 inches. After germination the hills are thinned down to a uniform stand of three plants per hill. The plants removed from each hill are taken at random—they are not selected. The crop is cultivated in a normal manner such as would be done by the better farmers in the district, with the possible exception that a little more chipping is done because of serious infestations of nut grass (*Cyperus rotundus*) in some paddocks.

The arrangement of the plots in the seasons prior to 1928-29 was of the systematic checker-board type with check plots every third. Since then Fisher's methods of randomised arrangements have been used, either as a latin square or randomised blocks. The number of plots of each variety varies from six to ten. Unpublished data from College Uniformity Trials suggest the use of a plot eight to ten rows wide and one chain long as being the most efficient. The plots in the trial, therefore, are ten rows wide and one chain long, and are thus about one-fourteenth of an acre in area. Between the ends of plots a lane 6 feet wide is left, but no space is left at the side of plots. To eliminate border effect at the sides of the field, two guard rows are sown on each side.

Not all of each plot is harvested for experiment purposes. The outer row on either side of each plot and the two end hills at each end of each row are discarded in order to eliminate competition and border effect respectively. The remainder of the inner eight rows of each plot are harvested and bagged separately. The area of this portion of the plot is about one-twenty-second of an acre. Later the ears are shelled, the grain weighed, and a representative 2-lb. sample is taken from the produce of each plot by means of a stick sampler. This sample is analysed for moisture content in a standard Brown Duvel tester, duplicate tests being made. All weights are then standardised to a uniform basis of 14 per cent. moisture in order to determine the true value of a variety in comparison with others.

Results.

The results of the trials conducted to date are given separately for each season in the accompanying tables. Only mean yields of varieties are given, and all yields are on a basis of 14 per cent. moisture. Individual plot yields are available to workers wishing to use them.

Any variety which is significantly better than another is also better than those lower in the table than the first one exceeded. No differences, other than those shown as such, are significant.

Season 1925-26.

Plan.—Systematic; two ranges each with every variety included once; check plot every third.

Plot Size.—Ten rows, 77 yds. long. *Planting Date.*—8th January, 1926.

Rainfall over Growing Period.—5·6 in. (drought year).

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Red Hogan (College) (Check)	21·95	4 *et seq.*
2. Fitzroy (New South Wales)	19·49	7 *et seq.*
3. Improved Yellow Dent (Queensland)	19·11	7 *et seq.*
4. Yellow Hogan (New South Wales)	17·05	8 *et seq.*
5. Funk's Yellow Dent (Queensland)	16·42	8 *et seq.*
6. Red Hogan (Queensland)	15·09	9
7. Golden Beauty (Queensland)	14·71	9
8. Golden Beauty (New South Wales)	12·07	..
9. Golden Nugget (New South Wales)	10·38	..

Analysis by means of check plot method, a calculated yield being determined for every plot, thus—Calculated yield of $A = \frac{2C_1 + C_2}{3}$ where the plot order is $C_1\ A\ B\ C_2$, etc.

S.E. single row = 5·44 per cent.

Season 1926-27.

Plan.—Systematic checkerboard; ten plots of each variety; check plot every third.

Plot Size.—Ten rows, 1 chain long. *Planting Date.*—30th December, 1926.

Rainfall over Growing Period.—16·74 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	42·88	6 *et seq.*
2. Improved Yellow Dent (Queensland)	41·33	6 *et seq.*
3. Golden Nugget (New South Wales)	37·17	6 *et seq.*
4. Yellow Hogan (New South Wales)	34·93	6 *et seq.*
5. Golden Beauty (Queensland)	29·60	6 *et seq.*
6. Red Hogan (College) (Check)	28·41	7
7. Golden Beauty (New South Wales)	24·62	..

Analysed by Student's method against check.

Season 1927-28.

Plan.—Systematic checkerboard; ten plots of each variety; check plot every third.

Plot Size.—Ten rows, 1 chain long. *Planting Date.*—28th December, 1927.

Rainfall over Growing Period.—24·35 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	62·81	3 *et seq.*
2. Improved Yellow Dent (Queensland)	60·21	3 *et seq.*
3. Golden Nugget (New South Wales)	49·05	4 *et seq.*
4. Golden Beauty (Queensland)	46·17	7
5. Red Hogan (College) (Check)	45·27	7
6. Yellow Hogan (New South Wales)	44·49	7
7. Golden Beauty (New South Wales)	37·15	..

Analysed by Student's method against check.

Season 1928-29.

Plan.—Nine Randomised Blocks. *Plot Size.*—Nine rows, 1 chain long.

Planting Date.—26th December, 1928. *Rainfall over Growing Period.*—16·74 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Golden Nugget (New South Wales)	63·3	6 *et seq.*
2. Improved Yellow Dent (Queensland)	59·9	10 *et seq.*
3. Improved Yellow Dent (College)	59·4	11 *et seq.*
4. Leaming (New South Wales)	59·2	11 *et seq.*
5. Fitzroy (College)	58·7	11 *et seq.*
6. Fitzroy (New South Wales)	57·9	11 *et seq.*
7. Giant White (New South Wales)	56·4	11 *et seq.*
8. Yellow Hogan (New South Wales)	55·9	12
9. Golden Beauty (Queensland)	55·2	12
10. Hickory King (New South Wales)	54·7	12
11. Manning Silvermine (New South Wales)	51·0	12
12. Golden Beauty (New South Wales)	37·3	..

Three blocks were discarded at harvest owing to the passage of storm waters across them. This upset the standard method of analysis, and hence no S.E. for the field was calculated. Significant differences were obtained by direct comparison of one variety with another.

Season 1929-30.

Plan.—Seven Randomised Blocks. *Plot Size.*—Five rows, 1 chain long.

Planting Date.—6th January, 1930. *Rainfall over Growing Period.*—19·17 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (Short)	73·6	6 *et seq.*
2. Fitzroy (New South Wales)	73·57	6 *et seq.*
3. Improved Yellow Dent (Queensland)	67·59	7 *et seq.*
4. Leaming (New South Wales)	67·27	7 *et seq.*
5. Fitzroy (College)	66·98	10 *et seq.*
6. Improved Yellow Dent (College)	62·11	13 *et seq.*
7. Yellow Hogan (New South Wales)	59·92	13 *et seq.*
8. Hickory King (New South Wales)	59·83	13 *et seq.*
9. Golden Beauty (Queensland)	59·59	13 *et seq.*
10. Golden Nugget (New South Wales)	57·27	14
11. Manning Silvermine (New South Wales)	56·49	14
12. Giant White (New South Wales)	56·13	14
13. Hickory King (Short)	51·17	..
14. Golden Beauty (New South Wales)	48·26	..

S.E. of a mean treatment yield = 2·54 per cent. or 1·56 bushels per acre.

Differences exceeding 3 × S.E. or 4·67 bushels per acre are significant.

The varieties marked "(Short)" were obtained from Mr. Short, Queen street, Grafton.

Considerable difficulty was experienced in obtaining seed supplies, and on this account only small plots of five rows could be sown.

Season 1930-31.

Plan.—Eight Randomised Blocks. *Plot Size.*—Ten rows, 1 chain long.
Planting Date.—11th January, 1931. *Rainfall over Growing Period.*—15·48 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Leaming (New South Wales)	56·16	5 *et seq.*
2. Improved Yellow Dent (Queensland)	51·00	11 *et seq.*
3. Improved Yellow Dent (College)	50.40	11 *et seq.*
4. Fitzroy (New South Wales)	49·0	12
5. Yellow Hogan (New South Wales)	48·51	12
6. Fitzroy (College)	47·32	..
7. Golden Nugget (New South Wales)	46·28	..
8. Kennedy (New South Wales)	45·23	..
9. Golden Beauty (Queensland)	44·9	..
10. Hickory King (New South Wales)	44·17	..
11. Golden Superb (New South Wales)	43·11	..
12. Giant White (New South Wales)	41·69	..

S.E. of a mean treatment yield is 2·46 bushels per acre.
Differences exceeding 3 × S.E. or 7·39 bushels per acre are significant.

Season 1931-32.

Plan.—Nine Randomised Blocks. *Plot Size.*—Ten rows, 1 chain long.
Planting Date.—8th January, 1932. *Rainfall over Growing Period.*—7·33 in. (drought year).

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	30·67	3 *et seq.*
2. Leaming (New South Wales)	25·9	5 *et seq.*
3. Fitzroy (College)	24·5	7 *et seq.*
4. Kennedy (New South Wales)	22·7	7 *et seq.*
5. Golden Nugget (New South Wales)	19·8	10 *et seq.*
6. Golden Superb (New South Wales)	19·5	11
7. Golden Beauty (Queensland)	16·4	..
8. Yellow Hogan (New South Wales)	15·8	..
9. Giant White (New South Wales)	15·6	..
10. Hickory King (New South Wales)	14·4	..
11. Fitzroy (New South Wales)	14·2	..

S.E. of a mean treatment yield = 1·73 bushels per acre.
Differences exceeding 3 S.E. or 5·2 bushels per acre are significant.

Season 1932-33.

Plan.—8 by 8 Latin Square. *Plot Size.*—Ten rows, 1 chain long.
Planting Date.—23rd November, 1932. *Rainfall over Growing Period.*—19·23 in.

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	54·55	4 *et seq.*
2. Improved Yellow Dent (Queensland)	53·73	4 *et seq.*
3. Fitzroy (College)	52·83	5 *et seq.*
4. Leaming (New South Wales)	49·65	5 *et seq.*
5. Golden Nugget (New South Wales)	45·55	6 *et seq.*
6. Red Nib	36·68	7 *et seq.*
7. Kennedy (New South Wales)	31·98	8
8. Golden Superb (New South Wales)	28·65	..

S.E. of a mean treatment yield = 1·09 bushels per acre.
Differences exceeding 3 S.E. or 3·27 bushels per acre are significant

SUMMARY OF RESULTS.

(Bushels per Acre—14 per cent. Moisture.)

—	1925-26.	1926-27.	1927-28.	1928-29.	1929-30	1930-31.	1931-32.	1932-33.
Fitzroy (New South Wales)	19·49	42·88	62·81	57·9	73·57	49·00	14·20	54·55
Improved Yellow Dent (Queensland)	19·11	41·33	60·21	59·9	67·59	51·0	30·7	53·73
Golden Nugget	10·38	37·17	49·05	63·3	57·27	46·28	19·8	45·55
Yellow Hogan	17·05	34·93	44·49	55·9	59·92	48·51	15·8	..
Golden Beauty (Queensland)	14·71	29·6	46·17	55·2	59·59	44·9	16·4	..
Golden Beauty (New South Wales)	12·07	24·62	37·15	37·3	48·26	..	..	..
Red Hogan (College) ..	21·95	28·41	45·27	..	..	..	..	..
Funk's Yellow Dent ..	16·42	..	..	..	..	..	..	..
Fitzroy (College)	..	..	..	58·7	66·98	47·32	24·5	52·83
Leaming	..	..	..	59·2	67·27	56·16	25·9	49·65
Giant White	..	..	..	56·4	56·13	41·69	15·6	..
Hickory King	..	..	..	54·7	59·83	44·17	14·44	..
Improved Yellow Dent (College)	..	..	..	59·4	62·11	50·4	..	..
Manning Silvermine ..	..	..	..	51·0	56·49	..	..	..
Kennedy	..	..	..	..	..	45·23	22·7	31·98
Golden Superb	..	..	..	..	..	43·11	19·5	28·65
Red Nib	..	..	..	..	..	..	..	36·68

COMPOSITE RESULTS.

The method of analysis is as for Randomised Blocks, each season being treated as a block. (*Maskell.*)

In each analysis only the longest period available for the varieties included has been given.

Period 1925-26 to 1927-28 (3 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	41·7	3 *et seq.*
2. Improved Yellow Dent (Queensland)	40·15	5 *et seq.*
3. Golden Nugget (New South Wales)	32·2	..
4. Yellow Hogan (New South Wales)	32·2	..
5. Red Hogan (College)	31·9	..
6. Golden Beauty (Queensland)	30·17	..
7. Golden Beauty (New South Wales)	24·6	..

S.E. of a mean treatment yield is 2·69 bushels per acre.

Differences exceeding 3 S.E. or 8·06 bushels per acre are significant.

Mean = 33·3 bushels per acre. Significant difference = 24·2 per cent. of mean.

Period 1925-26 to 1929-30 (5 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	51·34	3 *et seq.*
2. Improved Yellow Dent (Queensland)	49·6	4 *et seq.*
3. Golden Nugget (New South Wales)	43·5	6
4. Yellow Hogan (New South Wales)	42·5	6
5. Golden Beauty (Queensland)	41·1	6
6. Golden Beauty (New South Wales)	31·9	..

S.E. of a mean treatment yield = 2·29 bushels per acre. Differences exceeding 3 S.E. or 6·87 bushels per acre are significant.
Mean = 43·3 bushels per acre. Significant difference = 15·8 per cent. of mean.

Period 1925-26 to 1931-32 (7 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	47·1	3 *et seq.*
2. Fitzroy (New South Wales)	45·7	3 *et seq.*
3. Golden Nugget (New South Wales)	40·5	..
4. Yellow Hogan (New South Wales)	39·5	..
5. Golden Beauty (Queensland)	38·1	..

S.E. of a mean treatment yield = 1·64 bushels per acre.
Differences exceeding 3 S.E. or 4.91 bushels per acre are significant.
Mean = 42·2 bushels per acre. Significant difference = 11.6 per cent. of mean.

Period 1925-26 to 1932-33 (8 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	48·6	3
2. Fitzroy (New South Wales)	47·5	3
3. Golden Nugget (New South Wales)	41·7	..

S.E. of a mean treatment yield = 1·02 bushels per acre.
Differences exceeding 3 S.E. or 3·05 bushels per acre are significant.
Mean = 45·9 bushels per acre. Significant difference = 6.7 per cent. of mean.

Period 1928-29 to 1929-30 (2 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Fitzroy (New South Wales)	65·75	8 *et seq.*
2. Improved Yellow Dent (Queensland)	63·75	11 *et seq.*
3. Leaming (New South Wales)	63·25	11 *et seq.*
4. Fitzroy (College)	62·85	11 *et seq.*
5. Improved Yellow Dent (College)	60·75	12
6. Golden Nugget (New South Wales)	60·3	12
7. Yellow Hogan (New South Wales)	57·9	12
8. Golden Beauty (Queensland)	57·35	12
9. Hickory King (New South Wales)	57·25	12
10. Giant White (New South Wales)	56·25	12
11. Manning Silvermine (New South Wales) ..	53·75	12
12. Golden Beauty (New South Wales)	42·8	..

S.E. of a mean treatment yield = 2·71 bushels per acre.
Differences exceeding 3 S.E. or 8·14 bushels per acre are significant.
Mean = 58·5 bushels per acre. Significant difference = 13·9 per cent. of mean.

Period 1928-29 to 1930-31 (3 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Leaming (New South Wales)	60·9	8 *et seq.*
2. Fitzroy (New South Wales)	60·16	9 *et seq.*
3. Improved Yellow Dent (Queensland)	59·5	10
4. Fitzroy (College)	57·6	..
5. Improved Yellow Dent (College)	57·3	..
6. Golden Nugget (New South Wales)	55·6	..
7. Yellow Hogan (New South Wales)	54·8	..
8. Golden Beauty (Queensland)	53·2	..
9. Hickory King (New South Wales)	52·9	..
10. Giant White (New South Wales)	51·4	..

S.E. of a mean treatment yield = 2·36 bushels per acre.

Differences exceeding 3 S.E. or 7·08 bushels per acre are significant.

Mean = 56·34 bushels per acre. Significant difference = 12·5 per cent. of mean.

Period 1928-29 to 1931-32 (4 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	52·3	5 *et seq.*
2. Leaming (New South Wales)	52·15	6 *et seq.*
3 Fitzroy (College)	49·4	8 *et seq.*
4. Fitzroy (New South Wales)	48·7	9
5. Golden Nugget (New South Wales)	46·7	..
6. Yellow Hogan (New South Wales)	45·0	..
7. Golden Beauty (Queensland)	44·0	..
8. Hickory King (New South Wales)	43·3	..
9. Giant White (New South Wales)	42·45	..

S.E. of a mean treatment yield = 1·82 bushels per acre

Differences exceeding 3 S.E. or 5·47 bushels per acre are significant.

Mean = 4·71 bushels per acre. Significant difference = 11·6 per cent. of mean.

Period 1928-29 to 1932-33 (5 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	52·6	..
2. Leaming (New South Wales)	51·7	..
3. Fitzroy (College)	50·1	..
4. Fitzroy (New South Wales)	49·8	..
5. Golden Nugget (New South Wales)	46·5	..

Fisher's " Z " test showed no significance in the results.

Period 1930-31 to 1932-33 (3 Seasons.)

Variety.	Bushels per Acre.	Significantly Exceeds.
1. Improved Yellow Dent (Queensland)	45·1	..
2. Leaming (New South Wales)	43·9	..
3. Fitzroy (College)	41·5	..
4. Fitzroy (New South Wales)	39·3	..
5. Golden Nugget (New South Wales)	37·2	..
6. Kennedy (New South Wales)	33·3	..
7. Golden Superb (New South Wales)	30·4	..

Fisher's " Z " test showed that no differences were significant.

Summary of Composite Results.

The composite results may be summarised as under, significant differences only being included :—

Variety.	Superior to.	Inferior to.
1. Improved Yellow Dent (Queensland)	6–13	..
2. Fitzroy (New South Wales)	6–13	..
3. Leaming (New South Wales)	8–13	..
4. Fitzroy (College)	10–13	..
5. Improved Yellow Dent (College)	13	..
6. Red Hogan (College)	..	1, 2
7. Golden Nugget (New South Wales)	13	1, 2
8. Yellow Hogan (New South Wales)	13	1, 2, 3
9. Golden Beauty (Queensland)	13	1, 2, 3
10. Hickory King (New South Wales)	13	1–4
11. Giant White (New South Wales)	13	1–4
12. Manning Silvermine (New South Wales) ..	13	1–4
13 Golden Beauty (New South Wales)	..	1–5, 7–12

Discussion.

The results bring out clearly the need for replication over a number of seasons, and the danger of basing conclusions on the results of a single trial. Thus in 1931-32, a drought year, Fitzroy (New South Wales) came last, being significantly inferior to six other varieties, yet in the majority of seasons it has occupied a high place, and it is shown by a study of the composite results to be one of our most valuable varieties. Golden Nugget provides a similar case.

Another point of importance is the increased refinement in selection made possible when the trials are continued for several years. Thus for the composite results for the years 1925-26 and onwards it is seen that with trials over the first three years only differences of 24 per cent. of the mean can be adjudged significant. Over five years a difference of 15·8 per cent. of the mean is significant, over seven years 11·6 per cent., and over eight years 6·7 per cent. In other words, over the first three years only a difference of 8 bushels per acre is significant, over five years 6·87, over seven years 4·9, and over eight years 3·05 bushels per acre.

In the course of time new varieties were introduced into the trials, and those varieties which were proved inferior were from time to time discarded. After 1927-28, Red Hogan, although doing reasonably well, was discarded on account of commercial prejudice against its colour, and partly because of its starchiness and its being somewhat susceptible

to weevil. Golden Beauty (New South Wales) had by 1930 been definitely proved unsuitable, and Manning Silvermine was discarded at the same time. By 1932 the Queensland strain of Golden Beauty, together with Yellow Hogan, Giant White, and Hickory King, had proved their inferiority under Lockyer conditions, and these varieties were accordingly deleted. Improved Yellow Dent was not grown as a College farm crop after 1931, so that it became impossible to continue this variety for lack of seed.

Conclusions.

1. Improved Yellow Dent, Fitzroy, and Leaming prove to be the outstanding varieties (of those so far tested) for Lockyer Valley conditions. It is to be noted that of these the former two are late types, while Leaming is a mid-season variety.

2. Golden Nugget is also good, but slightly inferior to these three.

3. The varieties Red Hogan, Yellow Hogan, and Golden Beauty give fair yields, but are definitely inferior to the first three.

4. The strain of Golden Beauty, sold by the New South Wales Department of Agriculture, is definitely unsuited to the conditions of the Lockyer. Giant White, Manning Silvermine, and Hickory King are also inferior, and none of these varieties can be recommended for such districts as the Lockyer Valley.

5. The value of the varieties Kennedy, Golden Superb, and Red Nib has not yet been proved, and no recommendation can at present be made with regard to them.

6. It must be emphasised that these results are applicable only to the Lockyer Valley and to districts having similar soils and climatic conditions.

Other varieties are now under test, and in the season 1933-34 the varieties Funk's 90-Day and Durum are being added to the eight tested in 1932-33. The trials will be continued from year to year, and progressive results published when possible.

Acknowledgments.

The authors wish to express their gratitude to Professor J. K. Murray for his keen interest throughout the work and for his ready provision of facilities to carry it out. The bulk of the field work was ably done by Mr. E. McCarthy, Assistant to Plant Breeder. To the various assistants in the Plant Breeding Section who have from time to time assisted in various ways we also tender our thanks.

Thanks are also due to the State Departments of Agriculture of Queensland and New South Wales for having made the necessary supplies of seed available.

REFERENCES.

1. R. A. Fisher and J. Wishart. Imp. Bur. Soil Sci. Tech. Comm. No. 10.

2. E. J. Maskell. Trop. Agr. Vol. 5, No. 12; Vol. 6, Nos. 1, 2, 4.

NOTE.—Supplies of pure seed of Improved Yellow Dent may be obtained from the Department of Agriculture and Stock, Brisbane, and of Fitzroy from the Queensland Agricultural High School and College, Gatton.

Red maize is definitely unsuitable for export requirements, and there is also prejudice against it in local markets. In view of these facts and also on account of the proved superiority of yellow maize in these trials, the discontinuance of the use of red-grained types and the extension of the use of yellow types is strongly recommended.

QUEENSLAND VENEER TIMBERS.

More than twenty timbers in all shades of ornate colour and variety of figuring are available within the State for veneer and plywood purposes of all kinds, while the efficiency of the factories is such that the humblest cottage can be made beautiful by the use of choice vencered panels at low cost.

Such a natural advantage as this, coupled with the variety of native hardwoods of unexcelled durability eminently suitable for exterior sheetings and polished internal floorings, may well make home builders in other lands envious of their friends in Queensland.

In addition to work provided for timber and transport workers, the Queensland Veneer and Plywood Industry in 1933 provided direct employment for 448 hands in its factories.

Although the industry is only eighteen years old in this State, the capital invested has already grown to £370,000, and Queensland factories are now capable of supplying more than the present demand of the whole of the Australian States and New Zealand.

The following notes on Queensland veneer timbers, taken from a brochure entitled "The Veneer and Plywood Industry of Queensland," published by the Sub-Department of Forestry, Department of Public Lands, Queensland, will be read with interest by farmers and others who appreciate the economic value of Queensland woods. The fine plates illustrating this article are also reproduced through the courtesy of the Sub-Department of Forestry.

QUEENSLAND possesses a range of valuable veneer woods, which for beauty and utility are unsurpassed in any country of the world.

Many of the most famous cabinetwoods of the Old and New World are being replaced by Queensland woods of similar colour, figure, and lustre, capable of giving equal service under the most exacting conditions.

Foremost among these are Queensland Walnut, which is often almost identical in appearance to the best Italian and American Walnut, Maple Silkwood, a Mahogany type, and Silky Oak, the quartered figure of which surpasses that of the European Oaks while offering much greater facilities for working.

Ripple figured quarter sliced veneers of Queensland Satinay remind one strongly of figured Mahogany, while rotary-peeled Red Tulip Oak shows a particularly handsome soft tissue figure of tapestry effect which has no parallel in any other known wood.

Hoop Pine is the standard Queensland timber for all plywoods for plain joinery work, and is most largely used for the internal plies and cores of all types.

Following are short descriptions of the more important veneer woods in Queensland with particular reference to their botanical and trade nomenclature, sources of supply and log size, timber qualities, and uses.

QUEENSLAND WALNUT.

(*Endiandra palmerstoni.*)

The close resemblance of this wood to the Walnuts of the Northern Hemisphere gained for it the names of Queensland Walnut and Black Walnut from the date of its first discovery.

In the American trade, it became known variously as Australian, Oriental, and Queensland Walnut, Australian Laurel, and Oriental Wood, the last name being finally adopted by the Federal Trade Commission for the sole use of the trade in the United States.

Plate 43.—Veneer Logs in Hoop Pine Forest, South Queensland.

Walnut is one of the largest of Queensland trees, and is available only on the coastal Tablelands of North Queensland from Innisfail to Atherton, with Cairns as the port of shipment.

Mature trees attain a height of 120 to 140 feet, yielding boles up to 80 feet in length. Logs are sold in six classes ranging in measurement from 8 feet to 13 feet and over, centre girth under bark. They are not always, however, perfectly sound.

PLATE 44.—QUEENSLAND WALNUT, 9-FEET GIRTH (BREAST-HIGH), NORTH QUEENSLAND.

It has been estimated that some 40,000,000 superficial feet of Walnut logs are available in North Queensland.

Queensland Forest Service records show that Walnut was first recommended for veneering work in 1917. In February, 1922, the first veneering was done in Queensland by Messrs. D. G. Brims Limited, at Milton, on a log specially obtained from Atherton. The timber was found to peel exceptionally well for rotary-cut veneer, although dulling the knife edges a little more than other woods. Standard

sheets of three-ply were exhibited in the British Empire Exhibition, and the remainder were used for panelling the old Forest Products Showroom in William street, and for trade samples. The possibilities of Walnut were recognised by the Forest Service, and a strong publicity campaign was inaugurated. From this modest beginning developed the present overseas demand for this timber.

By 1925 a number of Walnut logs had been sold to local plywood manufacturers, but the plywood did not at once become popular, notwithstanding its attractive figure. Plywood made in Brisbane was at first all of the rotary type, and no

Plate 45.—Queensland Maple, 10-feet Girth (breast-high).

attempt was made to obtain the still more beautifully striped or rippled figure by the cutting of the veneers radially by a slicing machine. In Sydney, however, Messrs. Beale and Company used sliced veneers with excellent effect on Australian-made pianos and furniture panels.

Towards the end of 1927 a strong demand for Walnut logs arose in America, which had the effect of greatly reviving the timber trade in North Queensland

after months of depression. By March, 1928, more than 300,000 superficial feet of logs had been shipped to American veneering works. Here it was sold chiefly as Oriental Walnut, later becoming known also as Australian and Queensland Walnut, and from its family (Lauraceæ) Australian Laurel.

Strong objections were raised to the use of the name "Walnut" for the timber by the American Walnut Association, who contended that it was not a true Walnut. There is little doubt that this objection was due to the very successful competition of the Queensland wood for the same purposes as the American Walnut (*Juglans nigra*) which it strongly resembles.

PLATE 46.—SILKY OAK TREE (CARRYING FERNS) IN NORTH QUEENSLAND FOREST.

It was finally decided by the American Trade Commission that the wood must be sold only as Oriental Wood in the United States.

From July, 1928, the demand for Walnut logs greatly increased, and up to the end of the year over 2,000,000 superficial feet were exported to America alone. For the first six months of 1929 the quantity exported to America was 2,808,000 superficial feet, valued at £49,000 at the point of shipment. Exports were made chiefly to America, the United Kingdom, Canada, France, and Germany in order of quantity.

For the year July, 1931, to June, 1932, Queensland Forest Service records show that 1,296,000 superficial feet (Hoppus) of Walnut logs were removed from Crown lands in North Queensland. This represents an increase of 60 per cent. on the Crown sales for 1930-31.

In 1932-33, 560,000 superficial feet were sold.

Under the name of Australian or Oriental "Walnut" the following extracts are taken from Tropical Woods (1st June, 1929) as published by the Yale University, United States of America:—

> "The most recent addition to the American market of so-called Walnut woods is from Queensland, Australia. It appears to have been first introduced in 1927, by Russell Fortune, of Indianapolis, Ind., and has since become a serious competitor of American Walnut. It is known to the trade as Oriental Walnut, Oriental wood, Australian Walnut, Australian Laurel, and Queenswood.
>
> "The Imperial Institute (Descriptive List of some Empire Timbers, London, 1928, pp. 11-12) reports as follows:—'Queensland Walnut—A moderately heavy timber of a pale chocolate-brown colour, somewhat open in the grain and often presenting a fine wavy figure; a streaked figure sometimes occurs. The wood seasons rapidly, works well under the tool, planes to a smooth surface, and takes a good finish and polish. Weight 46 lb. per cubic foot. An excellent substitute for American Walnut. It is well suited for high-class furniture, cabinetwork, joinery, and interior decorative purposes, and is suggested for the manufacture of aircraft propellers. The streaked timber is valued for veneer, which is well suited for shopwindow and other panelling. Queensland Walnut would be useful for many purposes where a strong timber of good appearance is required.'
>
> "Mr. Karl Schmieg, recognised authority on cabinet-making and design, says:—'Queenswood (i.e., Queensland Walnut) is a remarkably fine wood, which runs very sound and uniform, keeps straight, takes glue well, and can be readily stained and polished. It has a greenish-yellow tinge and dark stripes, suggesting French Walnut more than the others, and is appropriate for use in combination with Ash, Oak, or any kind of Walnut. We have not used it in solid lumber, but have recently made a modern bedroom set to serve as a model for four hundred others for a hotel, and all of the surfaces, such as end panels, tops, and drawer fronts, are of Queensland veneer. I consider the wood suitable for modern interiors of offices, clubs, and hotels. The price at present is very reasonable.'"

A member of the American Walnut Manufacturers' Association made the following remarks regarding Queensland Walnut logs shipped to America:—

> "The logs are very striking in appearance, most of them from 14 to 16 feet long and running in diameter of from 30 inches to 40 inches. The bark has the appearance of Beech bark, except that it is reddish rather than grey. The sapwood is tremendous, the ring running from 2 inches to 3 inches wide. The sapwood is of a pinkish colour, and no way has been found to use it.
>
> "Forty to fifty per cent. of the logs show some kind of a figure. There is a great variation in this figure, but a mottle cross figure is not uncommon. When the plain wood is quartered, it produces a striped figure, not unlike the stripe to be obtained from American Walnut. It is this type of wood that has been in greatest demand, since much greater width quarters can be obtained from these large logs than from American Walnut.
>
> "Its advantages are that the veneers come wide and long; therefore can be used with the least possible waste. It is also economical from the standpoint of price."

The dark-striped "Walnut" figuring of Queensland Walnut seen most prominently in quarter-sliced veneers is due to decided variations in the depth of colour in the concentric growth rings of the trunk.

Mottled, fiddleback, and ripple figuring are the result of the interlocking of the wood fibres, and show the best effects in quartered veneers.

The following excellent description of this beautiful wood is taken from a publication issued by an American veneer manufacturer:—

"Very few commercial woods exhibit such a variety of attractive colours as this native of Queensland's forest. While there are many odd shades, difficult to briefly describe, the most prominent are the 'Salmon Red,' the 'Walnut tint,' and a third group ranging from grey to brown. In spite of the extreme variations of shades afforded by individual specimens, the logs are massive and, as previously stated, produce a large amount of veneer, rendering it easy to procure uniformly coloured material, even for large dimensioned wood work.

"Although the Oriental wood can be worked advantageously on the rotary lathe, the grain of the wood favours it being cut on the quarter. The figure thus produced consists of more or less parallel stripes of varying width which are often interrupted by rich cross figures of different types, the most common of which are the 'fiddleback,' 'broken roe,' 'mottle,' and 'finger roll' markings."

PLATE 47.—SNIGGING VENEER LOGS WITH TRACTOR IN A NORTH QUEENSLAND FOREST.

The use of Queensland Walnut veneered panelling, under the name of "Oriental" Walnut, in the carriages of the famous European tourist train "Golden Arrow" is a striking tribute to the beauty and utility of this valuable wood. This train is reputed to be the most luxurious in the world.

A considerable amount of veneering and panelling work in Queensland Walnut has also been carried out at the headquarters of the British Broadcasting Corporation.

Plate 48.—Two Red Tulip Oaks, 9-feet Girth (breast-high), North Queensland.

In Australia, Walnut veneered panels are used largely in the construction of high-class furniture, radio cabinets, and for the wall panelling of the best homes and public buildings. It has been used to an increasing extent in recent years with excellent effect in panelling the principal rooms of modern homes erected in Brisbane under the supervision of leading architects. For the best work quarter-sliced matched panels are most favoured.

MAPLE SILKWOOD.

(*Flindersia brayleyana* and *Flindersia pimenteliana*.)

Two distinct botanical identities are included under the official name Maple Silkwood, but the timbers are so similar with regard to colour, figure, and working qualities that they are grouped together for trade purposes. In North Queensland, *Flindersia brayleyana*, once called Red Beech, is now commonly known as Queensland Maple, while *Flindersia pimenteliana* is called Silkwood.

In the American trade the timber has been called Warri Wood.

Maple Silkwood grows only on the tablelands and coastal areas of the Atherton district in North Queensland. Both species attain a height of over 100 feet and logs are sold with girths ranging from 6 feet to over 14 feet measured under the bark at the centre. *Flindersia pimenteliana* usually produces a slimmer bole and is much less abundant.

The latest estimates of the quantity of Maple Silkwood available on Crown lands in North Queensland (December, 1929) are:—

Girth 8 feet and over (breast high) ..	77,000,000 superficial feet
Girth 5 feet to 8 feet	30,000,000 superficial feet
Total	107,000,000 superficial feet

To enable a sustained supply of this valuable timber to be secured for the future, the annual cut from Crown lands was regulated to 3,000,000 superficial feet for the three years from January, 1930, to January, 1933, but these limits were not reached by sales during this period. The minimum girths cut were 9 feet on the Tableland and 8 feet on the Coast and Molloy areas. Nearly 8,000,000 superficial feet of logs were cut on Crown lands during the five and a-half years period from January, 1924, to June, 1929, and nearly 3,500,000 superficial feet were cut in three years from July, 1929, to June, 1932.

The Department's policy of reforestation of this species will perpetuate supplies of Maple Silkwood.

Maple Silkwood is recognised as the finest cabinetwood in Australia. The wood has a pleasing flesh-pink colour with the lustre of satin. Quarter-sliced veneers almost always show a ribbon figure. The broken ribbon and ripple figuring found in butt veneers are particularly beautiful, having the appearance of shot silk. The best veneers are obtained from stumps, butt logs, and crotches of well-matured trees.

Maple Silkwood ranks as one of the best veneer woods of the world. It cuts cleanly without splitting and very wide and thin veneers can be successfully sliced.

The wood is very tough, and is almost equal in strength to English Oak.

Tests made by the Technological Museum, Sydney, on seasoned timber, gave the following results:—

Weight per cubic foot—37 lb.
Modulus of Rupture—13,300 lb. per square inch.
Modulus of Elasticity—1,649,000 lb. per square inch.

The average weight of seasoned timber is approximately 40 lb. per cubic foot.

Maple Silkwood responds readily to ammonia fuming, turning to attractive grey tones while enhancing the natural figuring.

For interior work it is very durable, and is prized for veneered furniture, panelling, doors, shop and office fittings, and joinery generally.

The beautiful symmetrical effects obtainable by the use of veneers of figured Maple Silkwood are well illustrated by the panelled work in the Board Room at the Headquarters of the National Society of Operative Printers and Assistants, Borough road, London.

In Australia Maple Silkwood matched panels are extensively used in the manufacture of the best furniture, where it is used for table tops, sideboard and wardrobe front panels and ends, dressing-table drawer fronts, and bedstead ends.

Maple Silkwood plywood is eminently suitable for aircraft work for which it is classed with Honduras Mahogany. Made to exacting specifications, Maple Silkwood plywood is utilised in wing and body sheeting, body bulkheads, and cabin furniture.

Plate 49.—Satinay Forest, Fraser Island, Queensland.

PLATE 50.—TRACTOR LOGGING IN HOOP PINE FOREST, CANUNGRA DISTRICT.

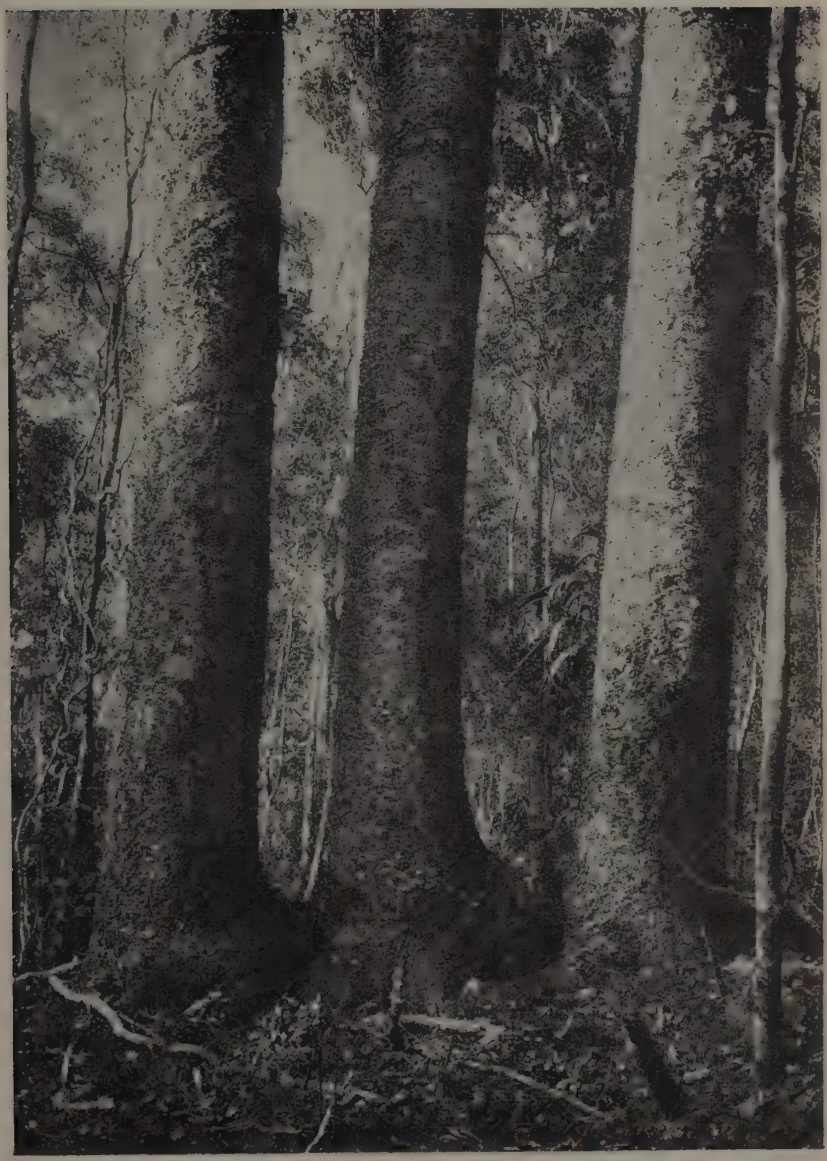


Plate 51.—"The Triplets."
Hoop Pines at Cainbable, Sarabah Range, South Queensland.

SILKY OAK.

(Cardwellia sublimis.)

The original Silky Oak of the Australian market was produced by two species (*Orites excelsa* and *Grevillea robusta*) occurring in the coastal areas of Southern Queensland and Northern New South Wales, but the North Queensland species (*Cardwellia sublimis*), is the Silky Oak of the veneer trade.

The three species, although somewhat alike in appearance and belonging to the same family, have different properties, the Northern species being superior for veneer purposes and providing the best logs.

Silky Oak (*Cardwellia sublimis*) is the largest tree of its family and is found only in the coastal areas in the vicinity of Innisfail and Cairns, North Queensland. The tree reaches a total height of 120 feet and its massive bole provides logs up to 10 feet and more in girth. The tree first known as Silky Oak in North Queensland was *Embothrium wickhamii* of the same family, and the present Silky Oak of the furniture trade was then more commonly called Bull Oak.

In America it is known as Lacewood, probably because of the lace-like appearance of rotary-cut veneers.

PLATE 52.—KAURI PINE LOGS.

The most recent estimate gives the quantity of Silky Oak log timber available on Crown lands in North Queensland as 105,000,000 superficial feet (Hoppus) of which 70,000,000 superficial feet is in logs measuring 8 feet and over in girth.

To provide for the future requirements of the timber industry while trees growing under sylvical operations attain milling size, the Queensland Forest Service in January, 1930, limited the annual log cut for a period of three years to 2,000,000 superficial feet. For the year 1932-33 998,000 superficial feet were sold by the Crown.

Customs figures for Queensland for 1932 show that 576,000 superficial feet of sawn Silky Oak were exported to United Kingdom alone during the year. This indicates that this timber is gaining in popularity abroad, and the greater use of veneered panels is following in the wake of the increased demand for sawn timber.

Silky Oak is second only to Maple Silkwood in popular esteem for cabinet purposes in Australia.

The timber is light and of a pale-pink colour, and owes its popularity chiefly to its ease of working and facility for staining coupled with its handsome "Oak" figuring, which can be varied by the angle of cutting with regard to its large medullary rays. The most striking "silver grain" is seen on quarter-sliced veneers.

When thoroughly seasoned, the wood has an average weight of 36 lb. per cubic foot.

Silky Oak is very tough for its weight and is excellent for holding screws. It takes glue readily but does not fume. On account of the weaving of the fibres through the large rays the transverse strength is considerably lower than that of Maple Silkwood, although ample for joinery and furniture purposes. The modulus of rupture averages about 8,000 lb. per square inch for good quality seasoned timber.

Plate 53.—Scarfing a Walnut Tree, 11-feet Girth, Atherton District.
Ripple Marks on Buttresses Indicate Figured Wood.

The wood is very durable even when exposed to the weather, and is a general favourite for casement windows which are usually oiled and varnished on the inside to show the attractive grain.

Silky Oak is well suited for veneering owing to its toughness and flexibility and the wide sheets which can be secured. Veneer sheets leave the knife smooth cut and free from checks.

Silky Oak plywood is extensively used for panelling in the best residences and in public banks, shops, and offices. It is also favoured for partitions, counters, and showcases.

In the furniture trade it finds extensive uses in wardrobes, sideboards, table tops, and other articles framed in solid timber.

Much of the beauty of Silky Oak is often lost through incorrect methods of finishing. Judicious staining is necessary to bring up the natural figuring to the best effect.

PLATE 54.—ROSE ALDER, NORTH QUEENSLAND.

RED TULIP OAK.

(*Tarrietia argyrodendron* var. *peralata.*)

Red Tulip Oak represents the largest and most valuable tree of the Sterculiaceæ family in Australia. It is a native of the tropical coastal forests of North Queensland, where it occurs on the Atherton Plateau and northward along the ranges towards the Daintree River. The tree reaches a height of 120 feet with a bole sometimes exceeding 10 feet in girth above its widely spurred base.

Above the spurs, excellent logs for rotary veneering are usually available, the trunk being long, straight, and cylindrical in shape.

Logs in girths ranging from 7 feet upwards are sold by the Forest Service f.o.b. or f.o.r. Cairns. The total quantity of log timber in North Queensland available for marketing has been estimated at more than 200,000,000 superficial feet.

It has been found from experience that the best logs for veneering are those containing light, mild timber, cut on sheltered sites. Production of low-grade veneers has resulted from the cutting in error of the harder allied woods, Brown Tulip Oak (*Tarrietia argyrodendron*) and Blush Tulip Oak (*Tarrietia actinophylla*).

Red Tulip Oak is a handsome veneer timber with colour variations in brown and reddish shades. During 1932 it became the most popular wood for the internal panelling of modern Brisbane homes. For this work rotary-peeled plywood gives the most attractive results because of the beautiful tracery effect of the concentric bands of soft tissue prominently exposed on this section.

Plate 55.—Silver Ash Veneer Log in a North Queensland Jungle.

Quarter-sliced veneers show the comparatively large medullary rays to the best advantage, but the general effect of the figuring is not so pleasing as that secured by rotary peeling.

Red Tulip Oak is a comparatively hard wood and has an average seasoned weight of approximately 50 lb. per cubic foot.

It is very strong and makes particularly strong plywood. A remarkable feature of the wood is its extremely high electrical insulating properties. Under test, rods 4 inches long have withstood a pressure of 33,000 volts for two minutes before failure.

For interior work Red Tulip Oak is very durable and gives long and satisfactory service. It is not adapted for exposure to the weather.

PLATE 56.—BLACK BEAN, 10 FEET IN GIRTH, ATHERTON DISTRICT, NORTH QUEENSLAND.

Red Tulip Oak plywood is at present used chiefly for decorative panelling of private residences, and for shop and office fittings.

Where plywood panelling is used in interiors it is usual to use moulded cover strips, and art rails of the same or some other figured wood to give harmonious results.

Finished in light tones the plywood is regarded as specially suitable for the interior panellings of motor launches.

Plate 57.—Queensland Maple resulting from Natural Regeneration Operations.

Plate 58.—Hoop Pine Plantation, ten years old, Atherton District.

QUEENSLAND SATINAY.

(Syncarpia hillii.)

Queensland Satinay has been so named by the Queensland Forest Service because of its resemblance in colour and figuring to the Satiné of French Guiana.

The timber is found in quantity only on Fraser Island, which extends for 80 miles along the Queensland coast, 20 miles east of the port of Maryborough. It prefers the sheltered dells of the immense sandhills forming the backbone of the island, flourishing where the rainfall exceeds 60 inches per annum.

Forest Service field estimates place the available supplies at around 50,000,000 superficial feet. It grows rapidly, regenerates naturally very readily, and rationed supplies can be maintained in perpetuity. Logs are available in centre girths under bark from 6 to 9 feet and over, but the smaller logs are not subject to pipes and provide lighter and more mellow timber, better suited for veneering.

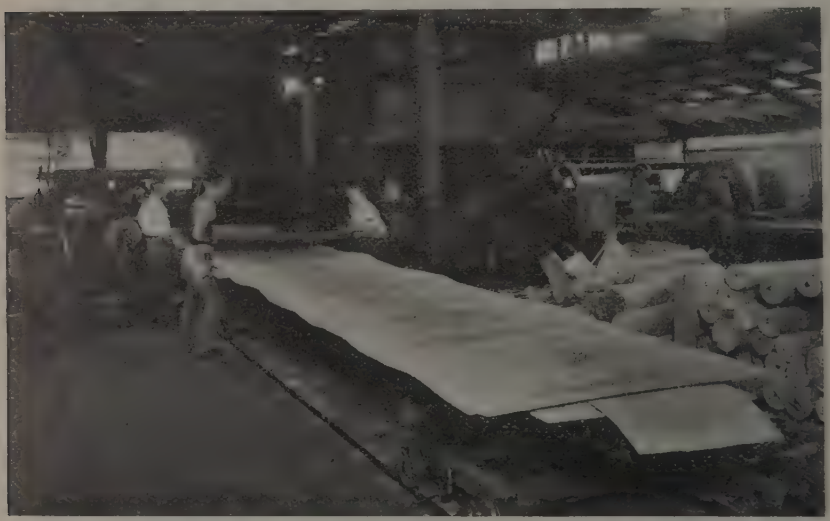


PLATE 59.—PEELING HOOP PINE LOGS ON ROTARY LATHE.

Queensland Satinay is a bright-pink close textured wood showing a beautiful lustrous broken ripple figuring on quarter-sliced veneers. By means of ammonia fuming the colour may be subdued to a greyish-plum tone, with velvet depths lit up by the ripple grain. Probably the most attractive treatment is the unique effect appropriately named "opal finish," because of the changing colours and light reflections of the undulating fibres produced by viewing the panels from different angles. For this purpose the veneers should be cut on the quarter at least ⅛ inch in thickness. Made up panels are then fumed to dark tones in an airtight chamber and afterwards sanded down about one-sixteenth of an inch or until the natural pink colour of the wood appears, where the fibres lie parallel with the surface and the fuming process has not penetrated so deeply. The variegated effects in colour and shading are then seen. The most brilliant results are obtainable by polishing with transparent French polish. "Opal finish" can only be applied to those rare woods which react chemically with deepening colour under the influence of ammonia fumes, and possess strongly interlocked fibres.

Seasoned Satinay has an average weight of 50 lb. per cubic foot. Timber from less mature trees may fall as low as 46 lb., while the inner flitches of very large logs may weigh up to 56 lb. per cubic foot.

The wood is very strong and Satinay plywood is probably the strongest in Australia.

Plate 60.—Log Dump in Hoop Pine Forest, South Queensland.

Plate 61.—Ply Logs on the way to the Mill.

PLATE 62.—HAULING PINE LOGS, IMBIL, SOUTH QUEENSLAND.

Static bending tests made by the Technological Museum, Sydney, showed an average modulus of rupture of 14,800 lb. per square inch for small clear specimens of the wood; with an average compression result parallel to the grain of 7,800 lb. per square inch.

To obtain the easiest cutting of veneers from Satinay, the logs should be sliced as soon as possible after felling, or after thorough boiling. Logs should be greased on the ends immediately after felling to prevent drying and splitting on the ends.

While extremely durable under all conditions, Satinay is also highly fire resistant, ranking first in this respect among all Australian cabinetwoods. Except for the white sapwood, not used in veneers or furniture, Satinay is not attacked by wood borers of any kind.

Satinay veneers, quarter sliced and matched, give excellent effects in wall panelling and for door panels in furniture. Variations in the depth of colour can be obtained by fuming or finishing with the "opal finish" described above. Wall panelling in the Forest Products Showroom, Brisbane, has given splendid service for over five years although exposed to great extremes of heat and humidity. Queensland Satinay has now proved its value for plywood panelling, and its popularity is increasing.

Considerable interest in this timber has recently been shown in America.

QUEENSLAND PINE.

(*Araucaria* spp. and *Agathis* spp.)

Queensland Pine plywood is constructed principally of Hoop Pine (*Araucaria cunninghamii*) with Bunya Pine (*Araucaria bidwillii*) and North Queensland Kauri Pine (*Agathis palmerstoni* and *A. microstachya*) in smaller quantities.

Hoop Pine extends along the whole length of the Queensland coast following the coastal hillsides from the New South Wales border to Cape York, but the largest Queensland supplies are found in the south-eastern corner of the State extending westward about 100 miles to the main Dividing Range. Bunya Pine is not nearly so abundant as Hoop Pine, and has a very restricted range between Gympie and the Bunya Mountains in Southern Queensland. Kauri Pine, as used in the veneer industry grows only in the mountainous coastal area in the Cairns district, North Queensland.

According to present Forest Service estimates the Queensland stand of Hoop and Bunya Pine of mature size (60 inches girth and over) is approximately 800,000,000 superficial feet.

Logs of plywood class represent about 100,000,000 superficial feet of this total.

In North Queensland the quantity of Kauri Pine on Crown lands has been estimated at approximately 125,000,000 superficial feet for trees 8 feet and over in girth breast high. In girths from 5 feet to 8 feet a further 30,000,000 superficial feet are available.

Both the Hoop and Bunya Pines grow to a large size, reaching 150 feet and more in height with girths up to a maximum of 10 feet and more. Although Bunya Pine is usually stouter, both species provide long cylindrical boles, yielding clear logs excellent for veneering purposes.

Kauri Pine reaches much the same height, while providing a much thicker bole from which logs up to 18 feet, and sometimes greater, girth are available. In shape and size Kauri provides the best veneer log in Queensland.

Hoop and Bunya Pine logs are sold in girth classes of 5 feet and upwards, while Kauri logs are rarely sold below 8 feet.

Queensland Pine is a close and even textured, firm cabinetwood of the highest quality. Its ivory colour and smooth finish are particularly attractive to the joiner and cabinet-maker, providing a medium which can be readily stained and finished in any colour desired.

It has considerable toughness and strength but is easily worked, glues and stains perfectly, and is normally non-aromatic.

Seasoned Hoop Pine weighs approximately 36 lb. per cubic foot, while Bunya Pine and North Queensland Kauri Pine average 33 lb. and 30 lb. respectively.

Hoop Pine plywood has the greatest firmness of surface, followed closely by Bunya Pine, with North Queensland Kauri Pine a little softer.

PLATE 63.—KAURI PINE LOGS FROM COOKTOWN, NORTH QUEENSLAND.

PLATE 64.—PROVIDING FUTURE SUPPLIES FOR THE PLYWOOD INDUSTRY.
Seventeen-year-old Kauri Pine Plantation, North Queensland.

Plate 65.—Cleaning and Cutting Logs to Length prior to Peeling.

Plate 66.—Log Entering Pit for Steaming before Peeling.

The colour of Hoop Pine is usually uniformly pale, while Bunya Pine frequently shows stronger figuring in pale-pink shades. Kauri is often seen in uniform shades of light-brown. Although unsuitable for outdoor use, these woods are very durable in interior furniture and joinery.

The relative strengths of Hoop and Bunya Pine compared with Oregon Pine (*Pseudotsuga taxifolia*) are given in the following table from Queensland Railway tests:—

Timber.	Number of Tests.	Moisture Content.	Transverse Modulus of Rupture.	Crushing (on end Grain).
		Per Cent.	Lb. per sq. in.	Lb. per sq. in.
Bunya Pine	3	14·6	13,870	7,830
Hoop Pine	7	13·8	12,830	7,620
Oregon Pine	20	11·3	10,840	6,780

Queensland pine is the standard plywood for all interior work to be stained, varnished, or painted. It is the best wood for corestock and centre plies in Australia, over nine-tenths of all the veneers cut being of Hoop Pine.

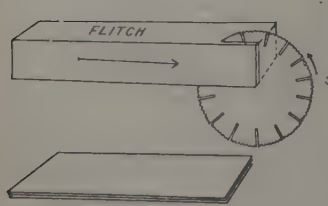
Queensland Pine plywood is very extensively used in the building industry for internal panellings, ceilings, door panels, and cabinets in houses, public buildings, and in shops and offices where it also finds service for counters, shelves, and partitions. In the furniture trade, stained and polished panels are used in medicine chests, wardrobes, dressing tables, bedsteads, and wardrobe doors and ends. It is also used almost exclusively for drawer bottoms, wardrobe mirror backs, and patterns.

Coachbuilders find the plywood of great service for linings, seats, and internal fittings of buses and trams. Boat builders use Hoop Pine for internal lining and panellings.

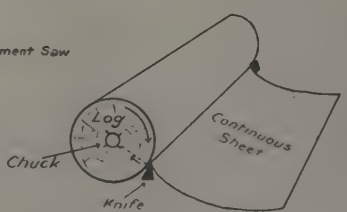
The Queensland dairy industry requires over 1,500,000 butter-boxes per annum, practically the whole of which are made of Hoop Pine and North Queensland Kauri Pine. The greater proportion of these are constructed in the form of wire-bound rotary-cut veneer boxes. Queensland Pine plywood also finds extensive use for a very large number of miscellaneous purposes, including camping kits, drawing boards, toys, and models, ping pong bats, radio cabinets, and waste-paper baskets.

Methods of Cutting Veneers

Showing Movements of Timber and Cutting Blades



1. Veneer Sawing.



2. Rotary Peeling.

PLATE 67.

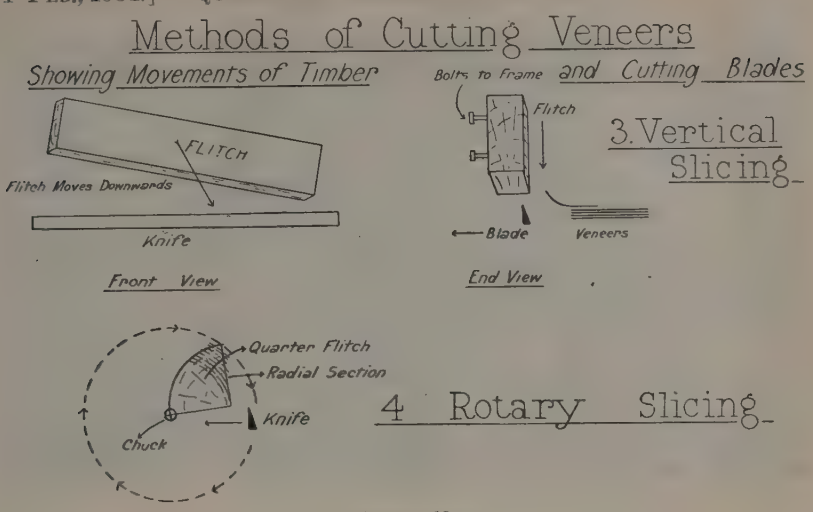


PLATE 68.

OTHER QUEENSLAND VENEER WOODS.

Amongst the Queensland timbers suitable for standard and fancy veneers and available in more or less limited quantities are the following:—

SILVER ASH (*Flindersia pubescens*).—A pleasing white, easily worked timber of the Maple Silkwood type in weight and texture and capable of being stained readily to any shade required. This wood makes a very high-grade plywood, and has at times a very pleasing figure. Rotary peeling gives the best effects. Logs are available from North Queensland.

SATIN SYCAMORE (*Ceratopetalum virchowii*) is similar in texture and working qualities to the Coachwood (*Ceratopetalum apetalum*) of New South Wales, but has a much more attractive figure. Rotary-cut veneer is well suited for interior decorative panelling. This wood grows only in the Atherton district in North Queensland.

ROSE ALDER (*Ackama quadrivalvis*).—This is a similar type to Satin Sycamore and grows in the same areas. It is, however, normally unfigured and presents a uniform bright-pink colour. It makes good rotary plywood.

ROSE WALNUT (*Cryptocarya erythroxylon*) is a native of Southern Queensland scrubs, and is available in large logs in moderate quantities. The plywood is pale-pink in colour with pleasing variations in shading. It is very strong and durable, and makes attractive wall panelling.

BLACK BEAN (*Castanospermum australe*) is sometimes veneered for overlaying furniture and for special panels. It cuts cleanly, and is often available in highly-figured wood, but the irregular shape of the trees makes the average returns of veneer rather low. The best logs are obtained in the Atherton district. The solid wood is often used for carving because of its mellow nature.

PLATE 69.—LOGS AWAITING PEELING AT A COUNTRY PLYWOOD FACTORY.

PLATE 70.—ROTARY LATHE IN OPERATION.

PLATE 71.—QUEENSLAND WALNUT LOG MARKED FOR SAWING INTO FLITCHES FOR QUARTER-SLICING.

NAMES OF QUEENSLAND VENEER WOODS.

Official Name.	Botanical Name.	Other Vernaculars.
Black Bean	*Castanospermum australe*	Beantree
Bunya Pine	*Araucaria bidwillii*	..
Canary Sassafras	*Doryphora sassafras*	Sassafras
Candlenut Siris	*Aleurites moluccana*	Candlenut
Hoop Pine	*Araucaria cunninghamii*	..
Ivorywood	*Siphonodon australe*	..
Kauri Pine	*Agathis palmerstoni*	..
Maple Silkwood	*Flindersia brayleyana*	Maple, Red Beech
	Flindersia pimenteliana	Silkwood
Queensland Satinay	*Syncarpia hillii*	..
Queensland Walnut	*Endiandra palmerstoni*	Walnut Bean, Black Walnut, Oriental Wood, Australian Laurel
Red Cedar	*Cedrela australis*	Cedar
Red Silkwood	*Lucuma galactoxyla*	Cairns Pencil Cedar
Red Siris	*Albizzia toona*	Acacia Cedar
Red Tulip Oak	*Tarrietia argyrodendron* var. *peralata*	Red Crowsfoot Elm
Rose Alder	*Ackama quadrivalvis*	Feathertop, Pencil Cedar
Rose Walnut	*Cryptocarya erythroxylon*	Pigeonberry Ash
Satin Sycamore	*Ceratopetalum virchowii*	Blood-in-the-bark
Silky Oak	*Cardwellia sublimis*	Bull Oak
Silver Ash	*Flindersia pubescens*	Ash
	Flindersia schottiana	Bumpy Ash
Silver Quandong	*Elæocarpus grandis*	Quandong
Tulip Cedar	*Melia azedarach*	White Cedar
Tulip Plum	*Pleiogynium solandri*	Burdekin Plum
White Aspen	*Pleiococca wilcoxiana*	Snowwood
White Hazelwood	*Symplocos spicata*	..
Yellow Cheesewood	*Sarcocephalus cordatus*	Leichhardt Tree
Yellowwood Ash	*Flindersia oxleyana*	..

ARE SOWS BETTER BACONERS THAN BARROWS?

A question that often crops up in the judging of pork and bacon pigs at agricultural shows is as to whether the sow will make up into better bacon than a barrow. The answer to such a question takes into consideration two phases. Sow pigs, particularly in warm climates, come in season very early, and one often notices sows awaiting slaughter that show distinct evidence of the oestral period (or of being on heat or in season). If slaughtered while in the feverish condition that accompanies the oestral period the meat will not set well nor will it be as good as is desirable in the finished form.

On the other hand, sow pigs produce a larger proportion of first-grade bacon, lean meat, than barrows, for sows are lighter in back fat and are thicker in the streak of lean meat running along the sides than is the case with males; on the other hand, there is less risk with barrow pigs, although it must be remembered that improper castration often results in the formation of deep-seated abscesses in the area of the scrotal sac, and many a good pen of barrow baconers has suffered at the hands of the judge who is discriminating and takes special care to examine that portion of the body referred to before giving his decision. Perhaps, after all, sow pigs do make the best bacon, but on the average so much depends on breeding, type, feeding, and handling that the matter of sex is virtually an unimportant one, and further the farmer has no control over the sex of his pigs so must make the best use possible of both boars and sows.

THE DAIRY INDUSTRY.

Supplied by the DAIRY BRANCH.

BREEDING.

Need for Better Cows.

The industry needs better cows, and the dairy farmers and breeders must breed and rear the better cows because they do not exist to the extent required at present. A great deal has been written on breeding. Practical breeders and scientific minds in collaboration have prepared sufficient data to enable the application of general principles to breeding, which if adopted by dairy farmers will lead to considerable improvement in their herd yields.

Mendel and His Theory.

The first to conclusively draw attention to the fact that there was a definite law of averages operating in respect to the transmission of characteristics from parents to progeny was Gregor Mendel. He was born in the year 1822, and was admitted to the King's Cloister, at Brünn, to be trained as a teacher. He was ordained a priest in 1847, went to Vienna from 1851 to 1853 to study mathematics, physics, and the natural sciences. He returned to the King's Cloister, of which, in 1868, he became prelate. In the Cloister garden at Brünn Mendel became an experimental plantgrower, and turned his attention to hybrids and hybridisation to discover the law governing reproductive behaviour.

It had been previously noted from breeding experiments with hybrids that among their descendants the hybrid kinds decreased while the pure kinds increased, but, so far, nobody had made a systematic classification and count of the whole of any hybrid's descendants through several generations. This Mendel set out to do and selected the ordinary edible pea as a suitable plant to use for the purpose.

Occurrence of Hybrids.

The result of Mendel's experiments was to show that hybrids do not breed erratically, as had been believed hitherto, but with extraordinary regularity. Since the finding of Mendel's papers in 1900 a considerable amount of scientific investigation has been made into what was known as the "Mendelian Theory," all of which has confirmed the extraordinary law of average operating in regard to the inheritance of characteristics.

In a previous article brief reference was made to the transmission of characteristics from the sire and dam to the progeny, and the terms "dominant" and "recessive" were used to distinguish between factors or characters which were apparent and those which were hidden or had seemingly disappeared. In the case where neither factor is dominant, however, we have an admixture between the two factors.

Law of Inheritance.

The following illustration of colour inheritance will indicate clearly the law which operates. Red crossed with red produces all red. White crossed with white produces all white. Red crossed with white produces all roan.

It will be observed that red and white are the true breeding colours and that roan is an admixture or cross of the red and white. Roan is therefore a hybrid, and when crossed with another roan should produce on the Mendelian average one pure red and one pure white to every two roans.

Roan crossed with red produces equal numbers of roans and reds, while the roan and white cross produces equal numbers of roans and whites.

The Sex Problem.

It will be evident to all that throughout the animal kingdom the most common character difference is that of sex. Careful research has shown that in many animals the male forms two types of germ-cells—namely, a male-determining cell and female-determining cell, which are formed in equal numbers. All animals do not follow this rule, however. In fowls, for instance, the position is reversed.

The calf is developed by the union of a male cell with a female cell, both of which contain the characteristics of the parents. Thus each joint cell, or the embryo calf, contains two sets of characteristics, one from each parent.

It will be evident from the foregoing that either of the individual factors in these sets of characteristics may be dominant while the other will be recessive, except where neither the male nor female factor is dominant, when the result will be an admixture of the two.

Inheritance from Sire and Dam.

Investigations have indicated that both parents contribute on the whole an equal number of characters to the offspring. It may happen, however, that the factors transmitted by the sire are dominant, and thus give the appearance of a greater inheritance from the sire. This actually does happen in the case of pure-bred bulls, which generally possess more dominant factors than the cows to which they are frequently mated.

Inbreeding, Line-breeding, and Outbreeding.

Modern investigations shed much light on the significance of these breeding practices, and indicate their value in breed improvement work, and at the same time their limitations.

Inbreeding.

In its broadest sense this term implies breeding between related individuals. As there are degrees of relationship, so there are degrees of inbreeding. If the animals are very closely related it constitutes intensive inbreeding, but if the animals are more distantly related the practice may be regarded as line-breeding.

The experience of all leading breeders shows that a considerable measure of inbreeding is necessary if uniformity in type or characteristics is to be attained. This is no new discovery, but was recognised by one of the earliest breeders—Robert Bakewell, who was born in Leicestershire in 1726 and died there in 1795.

Bakewell's Method.

The name of Robert Bakewell is famous, and reference is made to him in nearly all works on breeding. It is interesting to note his procedure in breeding. His chief successes were with cattle to produce beef and sheep to produce mutton.

About 1760, after travelling up and down the country to discover which were the best cattle to produce beef, he added to the stock already on his farm a bull from Westmoreland and several heifers from Warwickshire. The ordinary breeder would have sent this bull away when his eldest daughters were rising three and he was four or five years old, but because he could find no other bull to take his place Bakewell kept this bull till he was at least seven or eight years old and one of his sons was found fit to take his place. This son was also retained till one of his sons again was found fit to take his place.

This practice of selecting successive sires from his own stock was continued by Bakewell throughout his lifetime. A sire which left stock carrying the characters Bakewell desired them to carry was kept alive till a son was found which bred equally well or better. One of his sires was at least twelve or thirteen years old before being sent away. This meant that Bakewell's stock were very closely inbred.

Bakewell's method is perhaps more clearly indicated by his practice with sheep. When his flock, which, like his herd, started with the introduction of sheep from elsewhere, was established, other breeders wished to buy sires from him, but Bakewell would not sell sires; he would only let. Thus though the lambs they produced belonged to other breeders the sires still belonged to Bakewell, and those that bred the kind of stock Bakewell desired could be brought home again.

How many of our dairymen and breeders have wished that they could bring home again some sire whose worth was proved only after they had disposed of him? There is a lesson to be learnt in this story of Bakewell's practice.

Merits and Demerits of Inbreeding.

Many of the most noteworthy animals in the history of breeding have been the result of very close inbreeding, and this fact in itself should be sufficient to show that there is considerable merit in the practice. It has long been recognised that high-class inbred animals are prepotent. Unfortunately, closely inbred matings are just as likely to accentuate defects.

This tendency is, of course, very frequently seen in the human race, when certain heritable defects, such as feeble-mindedness, if present in a family, tend to show up following marriage within that family.

The question then arises: Is inbreeding harmful in itself? There is abundance of scientific evidence to show that it is not necessarily harmful, and, moreover, there is also plenty of practical evidence from our leading breeders. Experiments have been carried out in which rats have been bred under a system of brother to sister matings for twenty-five generations, and though in some strains there was deterioration, yet in certain selected ones no reduction in vigour, size, or fertility resulted.

The evidence shows that inbreeding tends to promote uniformity in characteristics. However, without rigid selection it will, as previously mentioned, accentuate harmful factors.

The stock that maintains its desirable characters under a system of inbreeding can be considered to have gained in value, for it would in consequence breed uniformly.

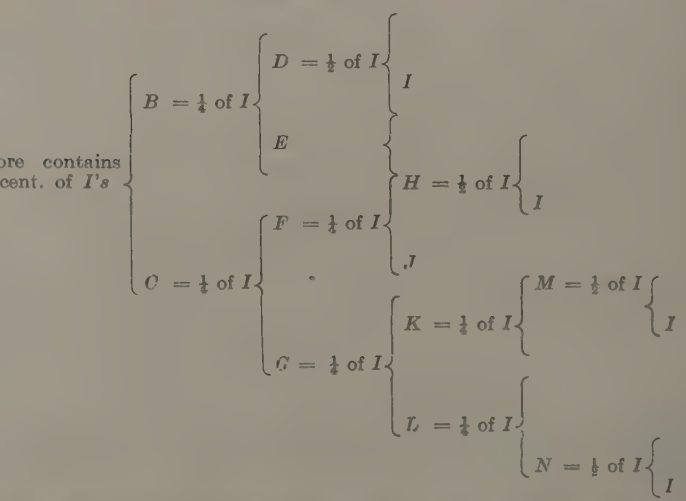
However, it must be stated that intensive inbreeding is a tool which should only be used in the hands of the big, skilled breeder who is prepared to cull drastically. The small breeder cannot afford to do much culling, and consequently should not be encouraged to conduct intensive inbreeding.

Line-breeding.

Line-breeding is a moderate form of inbreeding. It promotes a concentration of factors from related parents and thus tends to uniformity, though not necessarily to the same extent as inbreeding. It has the advantage of limiting also the accentuation of defects, and gives a considerable measure of control over heredity. It is a wise policy to follow in breeding, and it might be definitely said that, except where a strain does not possess the desirable breed characteristics, it is the only system which should be encouraged.

The following table is an example of line-breeding:—

LINE-BREEDING.



All animals shown in the pedigree except E and J carry a definite infusion of the blood of I. By this method desired individual characteristics of animals can be retained or even intensified in the progeny.

Outbreeding.

Outbreeding or outcrossing indicates a system of mating between animals of different strains or blood lines. Under such a system the variation in heritable factors must produce variation in the progeny. An outcross is only justified when it is desired to introduce some new combination of characters. Even then this should be followed by a renewed system of line-breeding, preferably to the blood of the favoured strain, and in this way the undesirable qualities of the original strain would be gradually eliminated.

Outbreeding often results in the production of very superior individuals. The progeny inherit the desirable dominant factors in both strains, but, being hybrids, their progeny breeds in the manner outlined in Mendel's experiments, and therefore as breeding animals they do not live up to their appearances.

Conclusion.

The subject of breeding is an extensive one. A prerequisite to the study of Mendelism is a good knowledge of mathematics. This article is therefore merely an elementary discourse on these subjects designed to interest dairy farmers in the laws which govern the inheritance of characteristics and by encouraging the adaptation of theory to practice lead to an improvement in breeding practices generally.

AGE AS A FACTOR IN BREEDING SOWS.

By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

The question is frequently asked, "How long will a breeding sow continue in profit; or, at what age should a boar be culled out? At what age is a sow at her best; and is a six year old boar too far down the hill to be productive?" These questions are not readily answered, because so many factors have to be taken into consideration. First and foremost, pigs are kept solely because they are profit makers, and once they reach the stage where they are unprofitable they should be rigorously culled irrespective of all their other qualities.

Secondly, they are not of sufficient value individually to warrant consideration unless they can produce at a maximum profit. No animals should be kept on the farm merely for the sake of keeping them, and at best it is almost cruel to pension an animal off unless funds are available to enable that animal to be properly fed and cared for.

Experience has shown that the best age at which to commence a sow on her stud duties is between eight, or ten, or twelve months old. Sows are invariably ready to mate at ten months of age, some of the larger breeds are big enough at eight months, but should not be mated too young, as the breeding organs do not develop as rapidly as the framework. The boar is invariably ready to work at ten months, and in his case, too, he should not be used too young. The length of life at which they remain profitable varies considerably. Some sows and boars are in their prime at five years of age, others have ceased to be profitable at that age. However, if properly cared for and maintained in reasonable breeding condition, there is no reason why both boar and sow should not be good breeders up to the age of eight years, although in general very few breeders reach that age.

Overseas experiments have demonstrated that the best breeders are those that are properly developed before their stud duties begin. Sows are better breeders if they are continuous breeders—that is, if they have two litters per annum regularly and are not allowed to lose time between litters. The boar is a better and more reliable sire if he is regularly in service and is maintained in breeding condition only. Over-fatness, lack of exercise and unbalanced rations are both detrimental to the productive capacity of breeding stock. Sluggishness is induced and sterility or barrenness encouraged more by over-feeding and by a lazy life than by regularity of feeding and stud duties. The boar is capable of mating with fifty sows per annum; the sow is capable of producing twenty young pigs each year, and it should be the objective of the pig-raiser to obtain maximum results, and even if he is not able to provide sufficient work for the boar, he certainly can maintain his sows at full profit, and when they reach the stage that they are on the down grade, both male and female should be culled to make way for younger and more productive animals.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Jersey Cattle Society, the Australian Illawarra Shorthorn Society, and the Friesian Cattle Club, production charts for which were compiled for the month of December, 1933 (273 days period unless otherwise stated):—

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
JERSEY.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Norwood of Fernlea	Kittle Brothers, Gleneagle	7,182·38	434·09	Oxford Palatine Butter Boy
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.				
Oxford Carnation	E. Burton and Sons, Wanora	5,212·38	314·236	Oxford Silvius
Oxford Clara	P. A. Smith, Miriam Vale	5,582	282·941	Trinity Ambassador.
Greenstock Buttercup (365 days)	J. B. Keys, Gowrie Little Plains	8,650·79	505·733	Carnation Larks Baron
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.				
Glenview Cowslip	F. P. Fowler and Sons, Coalstoun Lakes	4,782	304·722	Carlyle Larkspur 2nd Empire
Gunawah Opera Queen (251 days)	F. Maurer, Darra	5,558·28	301·869	Retford Prometheus
Golden Daffodil of Golden Hill	C. Klaus, Mundubbera	4,779	262·41	Hero of Golden Hill
AUSTRALIAN ILLAWARRA SHORTHORNS.				
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD, 290 LB.				
Alsia of Glengallon	R. Tweed Kandanga	8,168·8	329·478	Nobleman of Blacklands.
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.				
Murrays Bridge Phyllis 3rd	Hemmings Brothers, Murrays Bridge	6,522·5	277·878	Valiant of Greyleigh
Murrays Bridge Ivy 2nd	Hemmings Brothers, Murrays Bridge	6,204	266·292	Valiant of Greyleigh
FRIESIAN.				
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.				
Oaklands Nolly Rock (365 days)	W. Richters, Tingoora	13,781·26	519·601	Pied Rock

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Prickly Poppy.

S.C. (Allora)—

The specimen is *Argemone mexicana*, the Prickly Poppy, also known as Mexican Poppy. The plant is gazetted as a noxious pest throughout the State. It has been established in Queensland for a number of years, and is reputed to be poisonous to stock. However, stock generally leave it entirely alone. The only cases of poisoning by it that have come under our notice have been where the plants have been cut, allowed to wilt, and the wilted and softened plants eaten by calves.

Christmas Bells.

INQUIRER (Brisbane)—

The Christmas Bells are plants of the Lily family and belong to a genus called *Blandfordia*, which is confined to Australia, not being found in any other part of the world. Four species or different kinds are known. Three of these are found in the coastal swamps of the so-called "wallum" country of New South Wales and Queensland. The common species in Queensland is one of the largest of the genus, and is found in New South Wales as far south as Sydney. The fourth species occurs in Tasmania, ascending some of the mountains to a height of 4,000 feet.

The genus *Blandfordia* was named by Sir J. E. Smith, a famous English botanist, and first president of the Linnean Society of London, in compliment to George, Marquis of Blandford, and son of the second Duke of Marlborough.

The Australian *Blandfordias* were introduced into cultivation in England in the early part of the 19th century, and in an Encyclopædia of Plants, published by J. C. Loudon in 1829, they are described as "beautiful New Holland Liliaceous plants very rarely seen in English collections."

Bleeding Heart.

L.W. (Cairns)—

The specimen is *Homalanthus populifolius*, sometimes called Bleeding Heart owing to the fact that the leaves turn red with age. It has a wide distribution in Eastern Australia, from the Bulli district in New South Wales to the Atherton Tableland. It is sometimes called the Bulli Poison Bush, but stockowners on the Atherton Tableland have told us that they have fed the plant to stock during times of drought and found it to be quite a good fodder. It belongs to the family Euphorbiaceæ.

Wild Millet.

W.G.A. (Rockton)—

The specimen is *Echinochloa crus-galli*, commonly known as Wild Millet. It is a grass widely spread over the warmer regions of the world, and very variable in form and size. One form is a more or less common weed in cultivations in Queensland, particularly on the Darling Downs, and this seems to be the one you forward, but it is an annual grass and is quite a good fodder, being relished by all classes of stock. It is supposed to be one of the wild parents of such well known cultivated fodders as Japanese Millet and White Panicum.

Prickly Lettuce.

A.S. (Mount Larcom)—

The specimen is the Prickly Lettuce, *Lactuca scariola*. This plant is generally regarded as poisonous to stock, though it would only seem to be in exceptional circumstances that they eat it in sufficient quantity to cause trouble. Generally speaking, it is left untouched by them. The poisonous symptoms are said to be intoxication similar to that caused by poppy heads, narcotic effects being dominant.

Native Tobacco.

A.M.McL. (Springsure)—

Regarding your inquiry about *Nicotiana megalosiphon*, the Long-Flowered Native Tobacco, no feeding tests or chemical work have been carried out wtih this species. Dr. J. M. Petrie, working on what he termed *Nicotiana suaveolens*, found the plant to contain a large percentage of nicotine, and nicotine is among the most violent poisons known. Dr. Petrie estimated that there was enough nicotine contained in ½ lb. of the green plant to poison a sheep, but feeding tests carried out afterwards in New South Wales did not bear this out, though other feeding tests did.

Up till recent years all the Australian Nicotianas were known as *Nicotiana suaveolens*, the different forms being classed merely as varieties. These have mostly been raised to specific rank now. It is probable that their nicotine content varies. It probably varies also from district to district. All Nicotianas must be regarded as dangerous, and they are certainly not safe plants to have where children are running. If children did chew the plants I think they would be taken violently ill or death would ensue. Both leaves and flowers of other Solanaceous plants have been known to kill children, such plants, for instance, as Cork Wood, *Duboisia myoporoides*, and the Stramonium, *Datura stramonium*.

Maltese Cockspur.

T.A.C. (Chinchilla)—

The specimen is the Maltese Cockspur, *Centaurea melitensis*. This is an objectionable weed in the southern and the cooler parts of the State. If it has appeared on your property on an extensive scale you could try eradicating it by a chemical spray such as "Weedex." If only a few plants have established themselves they could be eradicated by hoeing out. In all cases it is preferable to deal with weeds of this type before they flower.

Broad-leaved Carpet Grass.

D.H. (Kuraby)—

The sample has been identified as the Broad-leaved Carpet Grass, *Axonopus compressus*. This grass has some value as a fodder on light soils or on second-grade country where the better pasture grasses will not flourish.

Bishop's Weed.

S.C. (Warwick)—

The specimen is *Ammi majus*, Bishop's Weed, a common European plant, grown a good deal in Australia under the name of Meadow Sweet. It is used extensively in the cut flower trade, but is not to be confused with the true Meadow Sweet of Britain. It has become naturalised in several localities, but so far as I know has not yet shown any tendency to become a noxious plant. It is very difficult to foretell the behaviour of these plants when once they begin to spread, but I do not think any fears should be entertained regarding the present specimen.

Caustic Creeper.

A.J.I. (Hodgson)—

Euphorbia Drummondii, Caustic Creeper.—In New South Wales this plant has been found to contain a prussic-acid-yielding glucoside, and when eaten in large quantities by travelling stock, particularly when hungry and on an empty stomach, a number of deaths may ensue. Repeated tests with the Queensland plant, however, have always given negative results, and the symptoms given certainly do not point to prussic-acid poisoning. The symptoms are that the head and neck swell to a large extent, and if the swelling is pierced an amber-coloured fluid runs out and the life of the sheep may be saved.

Capacity of Hayshed.

W.H.J. (Mount Larcom)—

A hayshed having dimensions 40 feet by 30 feet by 12 feet would hold approximately 32 tons of lucerne hay. A ton of lucerne hay would occupy approximately 450 cubic feet.

General Notes.

Staff Changes and Appointments.

Mr. J. W. Winlaw, Assistant Teacher of Manual Training Subjects, Rural School, Gayndah, has been appointed an Inspector under the Stock, Dairy, and Slaughtering Acts, Department of Agriculture and Stock.

Constable P. B. Guymer, Hungerford, has been appointed also an Inspector of Slaughter-houses.

The Officer of the Northern Territory Police stationed at Lake Nash has been appointed also an Acting Inspector of Stock, Queensland.

Mr. H. Bellert, junior, Fraser Island, has been appointed an Honorary Ranger under the Native Plants Protection Act.

Mr. E. J. R. Barke, Chemist in Charge, Sugar Experiment Station, South Johnstone, has been appointed Chemist in Charge, Sugar Experiment Station, Meringa.

Mr. F. G. Few, B.Sc., B.App.Sc. (Queensland), Assistant to Analyst, Agricultural Chemical Laboratory, Department of Agriculture and Stock, has been appointed Analyst, Agricultural Chemical Laboratory.

Mr. E. T. Lewin, Inspector of Stock, Julia Creek, and Mr. S. C. Allan, Inspector of Stock, Cloncurry, have been appointed also Inspectors of Slaughter-houses.

Animals and Birds Sanctuaries.

Whitsunday, Hook, and Gumbrell Islands have been declared sanctuaries for the protection of animals and birds by Order in Council issued 11th January, 1934. Other islands of the Group—namely, Hayman, the Double Cone, and Molle Groups—have already been declared sanctuaries under the Animals and Birds Acts.

Egg Board Election.

The election of a grower's representative for District No. 4 (Moreton) of the Egg Board resulted in the return of the retiring member, Mr. Alexander McLauchlan, Boonah, who received 117 votes as against 54 votes cast in favour of Mr. H. J. Jurgensen, Moogerah, via Kalbar. All of the other members of the Board—namely, Messrs. R. J. Corbett, A. A. Cousner, Tom Hallick, and W. T. Hughes—were returned unopposed. The new Board will be appointed for a term of one year as from the 1st January.

Honey Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, giving notice of intention to extend the operations of the Honey Board from the 9th March, 1934, until the 8th March, 1939.

A petition signed by 10 per cent. of the growers of honey and beeswax may be lodged on or before the 5th February next requesting that a vote may be taken on the question of the continuance of the Pool until March, 1939.

Nominations are also being invited for the election of four representatives on the Honey Board for a period of two years as from 9th March, 1934.

Rural Topics.

When Washing the Milk Cans.

Boiling water is absolutely necessary in dairy work to ensure cleanliness, and there should be no sparing of it. It is well, however, not to start washing the utensils with water that is boiling, for this very high temperature has a tendency to cause the albumen to coagulate, and stick to the utensil in a thin, often invisible, film that supplies a breeding ground for bacteria. The utensils should first be washed with warm water, with a little washing soda or other alkali added, using good brushware (cloths being very objectionable), after which they should be scalded in ample boiling water, and then placed in a clean place to dry.

Green Feed for Poultry—Precautions against Poisoning.

The poisonous properties of many weeds, and even of some fodder plants at certain stages (or if eaten in excess), is well known among big stock owners, but it is not generally recognised to what extent poultry become victims to unsuitable and even poisonous green stuff.

Many thousands of poultry are lost and many more are made ill (with a consequent los of egg-production) as a result of eating weeds of various kinds. This is nearly always brought about by circumstances and environment. For instance, a shortage of suitable green feed will cause the birds to eat many weeds that they would not otherwise touch. This particularly applies to birds kept in bare yards or confined to houses. If let out such birds will eat almost anything green. Naturally they will eat suitable fodders if available, but if not they will often eat unsuitable ones.

Obviously, too, if such birds are let out of bare yards on to a perfectly good class of green food they will eat to excess, and trouble in the form of digestive disorder will often ensue. How much more serious then may the trouble become if there are present one or more injurious plants instead of good edible fodder plants or grass. Birds roaming on free range will rarely eat poisonous weeds or any fodder in excess.

Another way in which poultry farmers encounter this trouble is in the green feed supplied to the pens. Take, for example, the farmer who is growing such crops as lucerne for green feed, cutting and feeding it to the birds in yards divested of any edible green feed whatever. Many cases came under notice where birds are dying or are falling off in production, where the cause is found to be some weed or unsuitable green feed that is being unsuspectingly fed with the other fodder, the farmer being under the impression that the birds will pick out only the suitable stuff. As a matter of fact, that is what would occur if there was sufficient of the good fodder, but in most such cases there is not, and hence the trouble.

Another source of trouble in connection with growing green feed for poultry is that it is often cut and fed at a stage when it has become too fibrous, and even contains some dead matter, such as dead flag of barley, &c. The trouble in this connection arises not so much from the excessive fibre content, but from the fact that such dead matter often forms itself into balls and prevents the passage of the other food from the crop to the gizzard, the only portion of the anatomy of the bird that can deal with it. The result of this stoppage is what is known as "sour crop," a condition that arises from fermentation of the food that is held back long after it should have passed on to the gizzard.

It will be seen how necessary it is for the poultry farmer to be ever on the alert to prevent these happenings, remembering always that if birds are kept short of their requirements in the way of succulent green feed, they are likely to eat too much when let out on to pasture of any kind. In cases where birds have been so kept, and it is desired to let them out of bare yards on to a growth of vegetation of any kind (even grass, if succulent) it is best to let them on to it for only half an hour to an hour at a time, gradually lengthening the period each day for a few days before allowing full access to the new run.—A. and P. Notes, N.S.W. Dept. Agric.

Molasses for Pigs.

The College of Agriculture, University of the Philippines, has recently carried out experiments on thirty-five pigs over a period of seven months to determine and compare the feeding value of molasses and corn as basal feed for growing pigs and sows for breeding purposes.

(1) In the mixture of feeds used in these experiments for growing pigs and young breeding sows, one part of molasses was equal to one part of corn in feeding value.

(2) Molasses can be substituted in part for corn when corn becomes scarce and expensive.

(3) To prepare an animal for show purposes molasses appears to be a very useful feed, as it imparts a smoothness and refinement to the general appearance of the animal, and has a beneficial effect on the digestive organs.

(4) Molasses is an appetiser, a conditioner, and a useful addition to feeding stuffs for pigs, but must not be fed in excess, or as a sole food, otherwise results will be unsatisfactory.

Fecundity Records in Pigs.

That fecundity is an hereditary factor in pig breeding is now generally recognised. The wise man buying a boar or a sow wants to know the farrowing records of the ancestors before he buys. When fecundity records were first introduced in Great Britain their usefulness and accuracy were not always accepted, but when the summaries of each year's records began to appear and pedigrees became something more than names, doubts disappeared.

Fecundity records and their development in the form of an advanced Register of Sows that have achieved a minimum standard of eight pigs reared in four consecutive litters within twenty-six months afford interesting evidence of the value of the collection and collation of records from the herds of breeders.

A typical illustration of the value of these records is noted on the pedigree and record of a well-known boar in England. The fecundity record of this animal shows that he is one of a litter of 12 born, 12 reared, that his sire was also from a litter of 12 born, 12 reared, and that his dam was from a litter of 11, all of which were reared.

With a record such as this, backed up by individual excellence of the ancestors and the boar himself, one would be quite justified in looking for even better results in the progeny of such an animal.

Railing Pigs in Crates in Queensland.

When stud pig breeders are railing pigs in crates from one station to another, they should remember that in order to discourage the use of cumbersome crates which are too large for a railway guard to safely unload at roadside stations, provision has been made in the railway goods By-laws for the rate for a half wagon to apply when the weight of a crate containing more than one animal exceeds 2 cwt.

Where two animals are to be forwarded and the total weight of pigs and crate exceeds 2 cwt., it is cheaper and better to forward in two crates.

Pig crates should be of a size to comfortably accommodate the animal, not too large or too small, and they should be made of soft wood and not of heavy ironbark boards. Details of crate measurements and other information pertaining thereto can always be obtained from the Department of Agriculture and Stock, Brisbane.

Lucerne as a Food for Pigs.

As a result of experiments in the use of lucerne as a food for pigs and to determine its effect on the quality of bacon and ham, Mr. G. E. J. Chaseling, of Coolabunia, Queensland, advises caution against fattening pigs on lucerne or allowing them to run on lucerne while they are being finished for market. Lucerne, he considers, is most excellent grazing for growing pigs, but they should be kept off it for at least six weeks before going to market. He refers to the "feedy flavour" given to milk by lucerne, and states it gives the same undesirable odour to pork, and lucerne-fed bacon takes on an ugly rusty appearance after being cured, which is most undesirable.

A Fair Question.

"What would a dairyman do to an orchardist who owned a diseased bull and allowed it to roam the district, or to the orchardist who sold milk and butter without being registered?" Mr. K. D. McGillivray, of Moorland, put this poser to delegates to the recent North Coast Agricultural Bureau Conference at Taree (N.S.W.), and answering the query himself he said that the law amply protected dairymen against such inconsiderate orchardists. "But what can the orchardist do to a dairy farmer whose neglected fruit trees are breeding and spreading pests and diseases, or to the dairy farmer who is unloading his surplus fruit on to a local market regardless of what price he gets for it?" continued Mr. McGillivray.

The law did not give orchardists as much protection as it gave dairymen, at least insofar as protecting them from unfair competition by those not legitimately engaged in the fruitgrowing industry. Mr. McGillivray considered that this state of affairs was due to the fruitgrowers not being as well organised as the dairy farmers. The orchardist did not want to deprive the farmer of the right to sell his surplus fruit, but he did think that farmers should not jeopardise the livelihood of commercial orchardists by allowing their neglected trees to become veritable breeding grounds for pests and diseases. Furthermore, he suggested that rather than sell their surplus fruit at any old price, they should ask a fair market value, the idea being not to depress prices, to the detriment of the commercial fruitgrower.

Cauliflower Cultivation.

Care in seed-bed work—more than is generally exercised—is essential if the growing of cauliflower (seed of which is usually sown from December to the early autumn months) is to give satisfactory returns.

It is very common to find growers using the same soil year after year for seed-beds because it is situated close to the water-tap. It has been proved that this procedure is responsible for the rapid spread of many of the most serious diseases. Again, insufficient attention is given to the preparation of the soil in the beds. To obtain the best results the beds should be prepared some weeks before sowing and given a liberal dressing of organic manure, which should be dug in and allowed to decay. A good practice is to give the bed a dressing of lime a few weeks before the soil is finally finished off for seeding. If artificial fertilizer is to be used in the seed-beds it should be in the form of superphosphate alone.

The seed should be planted in rows, at least 4 inches apart, made across the beds. This practice allows the seedlings sufficient room for development and also facilitates weeding. The seedlings are ready for transplanting to the field about two months after seeding.

Animal Health Station—A Grazier's Tribute.

Thus "An Old Timer" in a letter to the Editor of the "Courier-Mail" (29th December, 1933):—That article which you published in the "Courier-Mail" on Thursday about the work of the Animal Health Station at Yeerongpilly brought forcibly to my mind the splendid work that has been achieved in the last thirty years. My earliest memory of Queensland goes back to a most unfortunate incident of many years ago. My father made a "fine deal" for some Queensland bullocks. I can remember the day they arrived; great shaggy, long-horned, wild-eyed animals that appeared to be shivering with the cold blast that blew across the plains near Goulburn, in New South Wales. Within a week most of them were "down" with pleuro-pneumonia, and the disease took a terrible toll of them and of the rest of our cattle. At that time cattle were subjected also to anthrax, black-leg, and other deadly diseases. Years later, then in North Queensland, I had an experience—and a sad one, too—from redwater, a disease that brought ruination to many pastoralists. Nowadays we seldom hear anything of serious diseases in cattle.

I lift my hat, figuratively, to the veterinary surgeons who have captured and banished many of the dreadful stock diseases against which earlier breeders had to fight. Science has made wonderful strides in fighting the battle for the man on the land; it may have a long way still to go, and there might be a very vast field for it to clear up, but those whose memories can go back to the 'nineties and early nineteen hundreds will agree that a wonderful lot has been accomplished. Here's the best to the Animal Health Station at Yeerongpilly and all connected with it.

Big Cows or Little Cows?

Experiments conducted in America show that, so far as any definite statement can be made on the subject, the big dairy cow is more profitable than her smaller sister.

As a rule, large cows are better than the small ones for the production of milk and butter-fat. They also produce a higher income over food cost, in spite of the fact that they consume more roughage. The reason is that the larger animals require less food for maintenance per hundred pounds live weight. The energy expended in maintaining a living body can be measured in the heat radiated from that body. Radiation is in proportion to surface. The smaller animal has the greater surface in proportion to its weight, and consequently there is a greater radiation of heat from its body, and a greater consumption of food to supply energy.

Another reason why, for dairy purposes, a large animal is better than a small one is that the greater body space affords more room for the complicated "machinery" that is necessary to manufacture milk from food. Too often it is forgotten that milk is only made from food consumed. The amount of work performed by the heart and lungs of a heavy milking cow is enormous, so that any contraction in the region of the chest or any failure to pump an adequate blood supply through and around the udder, militates against big production.

In discussing the relative merits of the large and the small cow, the dual-purpose cow often confuses the issue. If an undue proportion of the food consumed is used for the manufacture of beef, the quantity available for milk production is proportionately reduced.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of unnecessary deaths.

HEALTH TALKS.

EVERY year about 6,000 children hear health talks given by the nurses of the Infant Welfare Railway Car. Sometimes they are asked to write little essays to show what they have learnt from these talks. Lately we have been shown some of these essays, which have pleased us so much that we are printing two of them. We have left out some sentences, but have made no alterations. We should like to explain that we do not ask children to drink no tea until they are twenty-one. We think that children under school age should drink no tea at all. They can be quite happy with milk and lemon drinks. If older children drink tea, it should be half milk. We hope that long before they are twenty-one they will have learnt to like tea that is not too strong and has plenty of milk in it.

The first essay is by a little girl of eight years. "There are three things we need to live—fresh air, fresh water, and food. We should sleep on a veranda or in a room with the doors and windows wide open. The best time to have a drink is to have it when we get out of bed in the morning, and we should have a bath then, too. We must eat foods that contain vitamins, such as all green vegetables, tomatoes, milk, eggs, nuts, cod liver oil, wholemeal, carrots, and fresh fruits. Arrowroot biscuits and soft, sweet, sticky toffee should not be eaten because they stick round the teeth, and a toothbrush will not get all out and so it decays the teeth. Children should not drink tea before they are twenty-one because it dries up the saliva in their mouths and then they have nothing to help them digest their food. And they do not need it because it is a drug and a stimulant."

The second essay is by a girl of twelve years. "The most essential way to keep healthy is to see that we have sufficient fresh air. We should sleep on the veranda if possible, and, if not, in a room which has the doors and windows wide open. The next essential to health is fresh water. We should drink plenty of water on rising in the morning. Plenty of fresh water should be used in having a daily bath. Also, there are the right kinds of foods. Every child should drink fresh cow's milk and eat wholemeal bread, green vegetables, tomatoes, butter, cheese, and eggs. By wholemeal bread is meant bread made with pure wholemeal flour, not bread darkened with syrup. Every mother should buy wholemeal flour for her children, as it can be used for making bread, scones, pastry, &c. Milk should be drunk at all meals, and water between meals. If mother gives us fruit for lunch we should eat it last, as it cleans our teeth and we cannot carry our toothbrushes to school. A sign with "Bad teeth sold here" should be pasted across all confectioners' shops so that children will realise what they are buying. Boiled lollies and barley sugar are the only sweets to be eaten by children."

Though we may not agree with every word, we think these essays prove that children are interested in health talks, remember what they hear, and can write it down afterwards. Education is a preparation for life, and good health is one of the most important things in life. Is it not strange that children are taught so little about health while at school? These children hear a lecture on health only once a year, but the children in Brisbane and other towns never hear any such lecture at all. Can they be really educated when they have not learnt the simplest rules for keeping in good health? We hope all school teachers and education authorities will put on their thinking caps and consider what can be done about this.

Orchard Notes for March.

THE COASTAL DISTRICTS.

IF the weather is favourable, all orchards, plantations, and vineyards should be cleaned up, and the ground brought into a good state of tilth so as to enable it to retain the necesary moisture for the proper development of trees or plants. As the wet season is frequently followed by dry autumn weather, this attention is important.

Banana plantations must be kept free from weeds, and suckering must be rigorously carried out, as there is no greater cause of injury to a banana plantation than neglect to cultivate. Good strong suckers will give good bunches of good fruit, whereas a lot of weedy overcrowded suckers will only give small bunches of undersized fruit that is hard to dispose of, even at a low price.

Cooler weather may tend to improve the carrying qualities of the fruit, but care must still be taken to see that it is not allowed to become over-developed before it is packed, otherwise it may arrive at its destination in an over-ripe and consequently unsaleable condition. The greatest care should be taken in grading and packing fruit. Only one size of fruit of even quality must be packed. Smaller or inferior fruit must never be packed with good large fruit, but must always be packed separately as required by regulation.

The marketing of the main crop of pineapples, both for canning and the fresh fruit trade, will be completed in the course of the month, and as soon as the fruit is disposed of plantations, which are apt to become somewhat dirty during the gathering of the crop, must be cleaned up. All weeds must be destroyed, and if blady grass has got hold anywhere it must be eradicated, even though a number of pineapple plants have to be sacrificed, for once a plantation becomes infested with this weed it takes possession and soon kills the crop. In addition to destroying all weed growth, the land should be well worked and brought into a state of thorough tilth.

In the Central and Northern districts, early varieties of the main crop of citrus fruits will ripen towards the end of the month. They will not be fully coloured, but they can be marketed as soon as they have developed sufficient sugar to be palatable; they should not be gathered whilst still sour and green. Citrus fruits of all kinds require the most careful handling, as a bruised fruit is a spoilt fruit, and is very liable to speck or rot. The fungus that causes specking cannot injure any fruit unless the skin is first injured. Fruit with perfect skin will eventually shrivel, but will not speck. Specking or blue mould can therefore be guarded against by the exercise of great care in handling and packing. At the same time, some fruit is always liable to become injured, either by mechanical means, such as thorn pricks, wind action, hail, punctures by sucking insects, fruit flies, the spotted peach moth, or gnawing insects injuring the skin. Any one of these injuries makes it easy for the spores of the fungus to enter the fruit and germinate. All such fruit must therefore be gathered and destroyed, and so minimise the risk of infection. When specked fruit is allowed to lie about in the orchard or to hang on the trees, or when it is left in the packing sheds, it is a constant source of danger, as millions of spores are produced by it. These spores are carried by the wind in every direction, and are ready to establish themselves whenever they come in contact with any fruit into which they can penetrate. Specking is accountable for a large percentage of loss frequently experienced in sending citrus fruits to the Southern States, especially early in the season, and as it can be largely prevented by the exercise of necessary care and attention, growers are urged not to neglect these important measures.

Fruit must be carefully graded for size and colour, and only one size of fruit of one quality should be packed in one case. The flat bushel-case (long packer) commonly used for citrus fruits does not lend itself to up-to-date methods of grading and packing, and we have yet to find a better case than the American orange case. Failing this case, a bushel-case suggested by the New South Wales Department of Agriculture is the most suitable for citrus fruits, and were it adopted it would be a simple matter to standardise the grades of our citrus fruit, as has been done in respect to apples packed in the standard bushel-case used generally for apples throughout the Commonwealth. The inside measurements of the case suggested are 18 in. long, 11¼ in. wide, and 10½ in. deep. This case has a capacity of 2,200 cubic inches, but is not included in the schedule of the regulations under "*The Fruit Cases Acts*, 1912-1922." The half-bushel case, No. 6 of the Schedule above referred to, is

10 in. by 11¾ in. by 5¼ in. inside measurements with a capacity of 1,100 cubic inches. The case should be suitable for oranges and the half-case of mandarins. No matter which case is used, the fruit must be sweated for seven days before it is sent to the Southern markets, in order to determine what fruit has been attacked by fruit fly, and also to enable bruised or injured fruit liable to speck to be removed prior to despatch.

Fruit fly must be fought systematically in all orchards, for if this important work is neglected there is always a very great risk of this pest causing serious loss to citrus growers.

The spotted peach moth frequently causes serious loss, especially in the case of navels. It can be treated in a similar manner to the codling moth of pip fruit, by spraying with arsenate of lead, but an even better remedy is not to grow any corn or other crop that harbours this pest in or near the orchard. Large sucking-moths also damage the ripening fruit. They are easily attracted by very ripe bananas or by a water-melon cut in pieces, and can be caught or destroyed by a flare or torch when feeding on these trap fruits. If this method of destruction is followed up for a few nights, the moth will soon be thinned out.

Strawberry planting may be continued during the month, and the advice given in last month's notes still holds good. Remember that no crop gives a better return for extra care and attention in the preparation of the land and for generous manuring than the strawberry.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE advice given in these notes for the last few months regarding the handling, grading, and packing of fruit should still be followed carefully. The later varieties of apples and other fruits are much better keepers than earlier-ripening sorts, and as they can be sent to comparatively distant markets, the necessity for very careful grading and packing is, if anything, greater than it is in the case of fruit sent to nearby markets for immediate consumption. Instruction in the most up-to-date methods of grading and packing fruit has been published by the Department, which advice and instruction should enable the growers in that district to market their produce in a much more attractive form.

The same care is necessary in the packing of grapes. Those who are not expert cannot do better than follow the methods of the most successful packers.

As soon as the crop of fruit has been disposed of, the orchard should be cleaned up, and the land worked. If this is done, many of the fruit-fly pupæ that are in the soil will be exposed to destruction in large numbers by birds, or by ants and other insects. If the ground is not worked and is covered with weed growth, there is little chance of the pupæ being destroyed.

Where citrus trees show signs of the want of water, they should be given an irrigation during the month, but if the fruit is well developed and approaching the ripening stage, it is not advisable to do more than keep the ground in a thorough state of tilth, unless the trees are suffering badly, as too much moisture is apt to produce a large, puffy fruit of poor quality and a bad shipper. A light watering is therefore all that is necessary in this case, especially if the orchard has been given the attention recommended in these notes from month to month.

Farm Notes for March.

LAND on which it is intended to plant winter cereals should be in a forward stage of preparation. Sowings of lucerne may be made at the latter end of the month on land which is free from weed growth and has been previously well prepared.

The March-April planting season has much in its favour, not the least of which is that weeds will not make such vigorous growth during the succeeding few months, and, as a consequence, the young lucerne plants will have an excellent opportunity of becoming well established.

Potato crops should be showing above ground, and should be well cultivated to keep the surface soil in good condition; also to destroy any weed growth.

In districts where blight has previously existed, or where there is the slightest possible chance of its appearing, preventive methods should be adopted—i.e., spraying with "Burgundy mixture"—when the plants are a few inches high and have formed the leaves; to be followed by a second, and, if necessary, a third spraying before the flowering stage is reached.

Maize crops which have fully ripened should be picked as soon as possible and the ears stored in well-ventilated corn cribs, or barns. Selected grain which is intended for future seed supplies should be well fumigated for twenty-four hours and subsequently aerated and stored in airtight containers. Weevils are usually very prevalent in the field at this time of the year and do considerable damage to the grain when in the husk.

The following crops for pig feed may be sown:—Mangel, sugar beet, turnips and swedes, rape, field cabbage, and carrots. Owing to the small nature of the seeds, the land should be worked up to a fine tilth before planting, and should contain ample moisture in the surface soil to ensure a good germination. Particular attention should be paid to all weed growth during the early stages of growth of the young plants.

As regular supplies of succulent fodder are essentials of success in dairying operations, consideration should be given to a definite cropping system throughout the autumn and winter, and to the preparation and manuring of the land well in advance of the periods allotted for the successive sowings of seed.

The early-planted cotton crops should be now ready for picking. This should not be done while there is any moisture on the bolls, either from showers or dew. Packed cotton showing any trace of dampness should be exposed to the sun for a few hours on tarpaulins, bags, or hessian sheets, before storage in bulk or bagging or baling for ginning. Sowings of prairie grass and *Phalaris bulbosa* (Toowoomba canary grass) may be made this month. Both are excellent winter grasses. Prairie grass does particularly well on scrub soil.

Dairymen who have maize crops which show no promise of returning satisfactory yields of grain would be well advised to convert these into ensilage to be used for winter feed. This, especially when fed in conjunction with lucerne or cowpea, is a valuable fodder. Where crops of Soudan grass, sorghum, white panicum, Japanese millet, and liberty millet have reached a suitable stage for converting into ensilage, it will be found that this method of conserving them has much to recommend it. Stacking with a framework of poles, and well weighting the fodder, is necessary for best results. All stacks should be protected from rain by topping off with a good covering of bush hay built to a full cave and held in position by means of weighted wires.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

CLIMATOLOGICAL TABLE—DECEMBER, 1933.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Date.	Min.	Date.	Rainfall. Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·76	87	73	91	28	67	18	623	13
Herberton	..	82	65	92	30	54	12	443	14
Rockhampton	29·85	87	70	96	14	64	30	400	12
Brisbane	29·93	82	67	88	15	63	20	520	19
Darling Downs.									
Dalby	29·90	84	62	93	13	55	16, 30	224	8
Stanthorpe	..	76	57	85	8, 13	47	16	514	17
Toowoomba	..	78	59	85	13, 14	52	30	443	19
Mid-interior.									
Georgetown	29·80	93	71	99	4, 24	68	3	616	11
Longreach	29·80	94	70	102	23	59	18	321	5
Mitchell	29·87	86	62	94	31	50	18	234	8
Western.									
Burketown	29·77	94	77	105	28	70	15, 16	484	8
Boulia	29·78	99	74	107	5, 6, 25,	63	17, 18	23	2
Thargomindah	29·84	91	70	102	31	61	15, 16	229	4

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF DECEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING DECEMBER, 1933, AND 1932, FOR COMPARISON.

Divisions and Stations.	Average Rainfall. Dec.,	No. of Years' Records.	Total Rainfall. Dec., 1933.	Dec., 1932.
North Coast.	In.		In.	In.
Atherton	7·60	32	7·60	9·62
Cairns	9·06	51	7·65	15·49
Cardwell	8·22	61	22·33	9·17
Cooktown	6·84	57	6·23	9·23
Herberton	5·90	47	4·43	7·17
Ingham	6·93	41	18·50	11·43
Innisfail	12·07	52	18·92	27·01
Mossman Mill	11·22	20	11·89	14·84
Townsville	5·55	62	11·41	8·63
Central Coast.				
Ayr	4·14	46	2·38	4·80
Bowen	4·49	62	3·73	3·53
Charters Towers	3·41	51	1·77	3·09
Mackay	7·29	62	5·75	11·37
Proserpine	8·23	30	4·81	8·35
St. Lawrence	4·84	62	3·41	9·70
South Coast.				
Biggenden	4·53	34	6·74	2·39
Bundaberg	4·98	50	9·48	2·68
Brisbane	4·89	82	5·20	2·49
Caboolture	5·14	46	12·39	1·31
Childers	5·57	38	9·96	4·24
Crohamhurst	6·92	40	16·24	1·82
Esk	4·69	46	5·56	2·49
Gayndah	4·17	62	2·87	2·09
Gympie	5·99	63	9·24	2·67
Kilkivan	4·47	54	6·72	2·21
Maryborough	4·75	61	9·67	4·25
Nambour	6·78	37	13·71	3·14
Nanango	3·82	51	4·21	3·83
Rockhampton	4·87	62	4·00	9·54
Woodford	5·57	46	11·15	3·54

Divisions and Stations.	Average Rainfall. Dec.,	No. of Years' Records.	Total Rainfall. Dec., 1933.	Dec., 1932.
Central Highlands.	In.		In.	In.
Clermont	3·96	62	1·97	1·75
Gindie	2·90	34	0	1·53
Springsure	3·27	64	0·86	1·80
Darling Downs.				
Dalby	3·25	63	2·24	4·77
Emu Vale	3·48	37	3·70	3·28
Hermitage	2·94	27	2·40	2·86
Jimbour	3·22	45	1·87	2·98
Miles	3·07	48	3·02	2·17
Stanthorpe	3·51	60	5·14	3·10
Toowoomba	4·42	61	4·43	3·69
Warwick	3·39	68	3·68	3·40
Maranoa.				
Roma	2·53	59	1·18	2·61
State Farms, &c.				
Bungeworgorai	3·02	19	0·92	1·88
Gatton College	3·63	34	4·48	1·46
Kairi	6·35	19	9·70	9·49
Mackay Sugar Experiment Station	8·49	36	5·72	8·03

GEORGE G. BOND, Divisional Meteorologist.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	February. 1934.		March. 1934.		Feb. 1934.	Mar. 1934.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					MOONRISE.	
					p.m.	p.m.
1	5·24	6·46	5·45	6·25	7·40	6·11
2	5·25	6·45	5·46	6·24	8·10	6·41
2	5·26	6·44	5·46	6·22	8·38	7·11
4	5·27	6·44	5·47	6·21	9·9	7·42
5	5·28	6·43	5·48	6·20	9·41	8·18
6	5·29	6·43	5·48	6·19	10·15	8·58
7	5·30	6·42	5·49	6·18	10·57	9·44
8	5·30	6 42	5·49	6·17	11·47	10·38
9	5·31	6·41	5·50	6·16	..	11·39
					a.m.	a.m.
10	5·32	6·41	5·51	6·14	12·47	..
11	5·32	6·40	5·52	6·13	1·51	12·45
12	5·33	6·40	5·52	6·11	3·0	1·52
13	5·34	6·39	5·53	6·10	4·11	3·3
14	5·34	6·39	5·54	6·9	5·23	4·9
15	5·35	6·38	5·55	6·8	6·30	5·14
16	5·36	6·38	5·56	6·6	7·34	6·17
17	5·36	6·37	5·56	6·5	8·37	7·18
18	5·37	6·36	5·56	6·4	9·37	8·21
19	5·37	6·35	5·56	6·4	10·36	9·20
20	5·38	6·34	5·56	6·3	11·36	10·21
					p.m.	
21	5·38	6·33	5·56	6·2	12·32	11·17
22	5·39	6·32	5·56	6·1	1·28	12·12
						p.m.
23	5·39	6·31	5·56	6·1	2·22	1·2
24	5·40	6·30	5·56	6·0	3·11	1·49
25	5·41	6·29	5·57	5·58	3·35	2·32
26	5·43	6·27	5·57	5·57	4·36	3·9
27	5·44	6·26	5·58	5·55	5·9	3·41
28	5·45	6·25	5·59	5·54	5·42	4·12
29	..	..	6·0	5·52	..	4·41
30	..	..	6·1	5·51	..	5·12
31	..	..	6·2	5·50	..	5·44

Phases of the Moon, Occultations, &c.

7 Feb.	☽ Last Quarter	7	22 p.m.
14 ,,	● New Moon	10	43 a.m.
21 ,,	☾ First Quarter	4	5 p.m.

Perigee, 12th February, at 9.18 p.m.
Apogee, 24th February, at 8.12 p.m.

On the 2nd, about 7 p.m., the Moon will be passing from west to east of Neptune, 3 degrees on its south side.

Venus, which has been drawing towards the Sun for some months, will be in inferior conjunction on the 5th, when it will be on the side of its orbit nearest the earth; distant about 23,678,000 miles. On the 14th it will rise at 4.37 a.m.

Jupiter, having advanced to Right Ascension 13·27 in Virgo, will become stationary on the 7th and almost to the end of the month. Retracing its path and apparently moving westward it will pass Spica, at a distance of 4 degrees, near the middle of March.

Saturn, in Capricornus, which sets at 8.13 p.m. in the middle of January, will draw nearer the Sun and set a few minutes after it on 1st February. On the 8th it will set with the Sun, but 2 degrees further south, becoming entirely lost as an evening star. At the time of the eclipse on the 14th, Saturn will be only one degree south of the Moon.

An occultation of Antares, the brightest star in Scorpio, will occur between 7 and 8 a.m. on the 9th. Observers will have to look almost overhead, especially if near Gympie or Maryborough. On the same day a very close conjunction of Mercury and Mars, in Aquarius, will occur about 9 a.m. in the north-east in broad daylight. Mercury will set 51 minutes after the Sun on the 9th, but after sunset may be noticeable in the twilight. Mercury sets at 7.20 p.m. on 1st February, and at 7.31 p.m. on the 14th, while Mars sets at 7.42 p.m. on the 1st and at 7.22 p.m. on the 15th.

What will be a total eclipse of the Sun to observers situated in the Pacific Ocean, between Alaska and New Guinea, will be a partial eclipse at Hong Kong, magnitude 0·5, and visible in Queensland as a partial eclipse of less magnitude before 9 a.m.

Mars will be only 3 degrees south of the Moon at 11 a.m. on the 15th. Binoculars or telescope will be necessary to see it. Eight hours later Mercury, in Aquarius, will be only 2 degrees south of the Moon when setting. On the 18th, Mercury will be at its greatest eastern elongation, 18 degrees from the Sun.

On the 24th, Mercury and Venus will become stationary, having reached their greatest eastern position in Aquarius and Capricornus respectively.

1 Mar.	○ Full Moon	8	26 p.m.
9 ,,	☽ Last Quarter	4	6 a.m.
15 ,,	● New Moon	10	8 p.m.
23 ,,	☾ First Quarter	11	44 a.m.

Perigee, 12th March, at 7.42 p.m.
Apogee, 24th March, at 3.54 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.